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ABSTRACT

Renewal is the focus of this curriculum designed for students in kindergarten through Grade 8. The purpose of this guide is to educate students and teachers about the problems faced in managing the amount of solid waste generated by society. Each grade level curriculum is organized into activities that support exploration of the nature of solid waste, how to manage solid waste, and what can be done to solve the problem. Each activity in the integrated curriculum model reflects elements of the arts, communication skills, science, mathematics, and social studies curricula. Four major solid waste topics are employed in the activities at each grade level: (1) reduce, reuse, and recycle (the three r's); (2) packaging; (3) waste disposal; and (4) natural resources. A materials list, time frame, vocabulary, and procedures, are included for each activity. Appendices include: a list of solid waste management and recycling support agencies; a list of recycling periodicals; preferred and innovative packing practices; school recycling; Federal Trade Commission (FTC) Guidelines on Environmental Marketing; bulk mail reduction; a list of sources for funding and awards program; a list of curricula and education materials; games and activities; and graphs and data. Contains 68 references. (DDR)

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Solid Waste Management in North Carolina

NC
Reduce Reuse Recycle

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DPPEA

The North Carolina Division of Pollution Prevention and Environmental Assistance provides free, non-regulatory technical assistance and education on methods to eliminate, reduce, or recycle wastes before they become pollutants or require disposal.

This manual is designed to be used as a reference and resource document. Please feel free to duplicate its contents, however, we ask that when duplicating material, you credit the North Carolina Solid Waste Management Curriculum Resource Guide, Watauga County Schools, September, 1995.

This document is brought to you in part by the Office of Environmental Education, which also offers the *Teacher's Guide to Environmental Education Programs and Resources*. K-12 programs and resources of the North Carolina Zoo, Aquariums, Forests, Parks, Museum of Natural Sciences, Wildlife Resources Commission, and many others are catalogued for easy reference. The guide is organized into four main categories: Environmental Education Programs and Activities That Come To You, Environmental Education Field Trips and Site Visits, Educational Opportunities For Teachers, and Environmental Education Support Materials. For your free copy contact:

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for
North Carolina

A
Curriculum Resource Guide
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CONSIDER RENEWAL

Be still, listen and surely you may hear
Mother Earth crying for what she must bear
Polluted water running through every vein
Parched, weary land showing the strain.

Tree roots clutching at eroding soil
Rivers gasping from industries spilled oil.
Mother Earth, softly crying in sorrow
Knowing there may not be a tomorrow.

Visions of nations with people to feed
Hungry children reaching out in need
Mother Earth giving up in despair
Too drained of strength to repair.

Yet life-saving methods can be used
To restore a land so thoughtlessly abused
To begin the replenishment needed now
With calloused hands and sweat-stained brow.

The time is now, renewal must begin
Before our natural resources come to an end
Renewal of water, land and trees must be employed
For life on this earth to be enjoyed.

For our children's sake, for our future's sake
We must begin to right the abuse and mistake
Of short-sighted vision, no planning at all
Be still, listen quietly and hear the call.

Consider renewal.....Consider it now.

Compliments of...
Blue Ridge Environmental Defense League

INTRODUCTION

What is Solid Waste?

Commonly referred to as garbage, solid waste is any unwanted and discarded material that is not a gas or liquid. Solid waste can come from homes, businesses, institutions, industries, construction sites, agriculture operations, and mines. Before the industrial revolution, most solid waste was organic, thus biodegradable. Today we produce, use and throw away huge amounts of non-biodegradable solid waste (e.g. plastics, Styrofoam, etc.) that is basically permanent in our environment. Over three hundred million tons of solid waste are produced annually from all types of human activity in the United States alone. This waste includes: food waste, containers, plastics, textiles, abandoned automobiles, dead animals, construction and demolition scrap materials, waste treatment sludges, and hazardous materials that are toxic, reactive, ignitable, or corrosive. Of this waste, approximately 195 million tons are municipal solid wastes (homes, businesses, institutions). In North Carolina, we dispose of an average of 5.6 pounds of garbage per person, per day (1993-94). Across the United States, an average of 4.3 pounds of garbage is disposed of per person, per day! This is enough waste to fill a fleet of garbage trucks that would circle the earth over 6 times.

How Do We Manage Solid Waste?

What do we do with our solid waste? The majority, approximately 67%, is disposed of in landfills. Landfills cannot be located just anywhere due to geological barriers. Leachate from landfills can seep into groundwater, which is the drinking water for approximately 50% of Americans. Government regulations now require that new landfills be high-tech with plastic liners and leachate collection systems, but the Environmental Protection Agency feels that even these new landfills could eventually leak. Some solid waste is incinerated or burned to both reduce the amount of waste and to generate energy. While incinerators may not directly pollute the water, they may emit particulates into the air, even if pollution control devices are present. The remaining ash, of which one ton is produced for every 10 tons of waste burned, must also be properly disposed and may contain heavy metals or other materials. Just over 20% of our solid waste is recycled, while 10% is incinerated, and 67% is put into landfills.

What Can We Do?

The purpose of this curriculum is to educate students and teachers about the problems we face while trying to manage the amount of solid waste that our society generates. With an understanding of the problems of solid waste, we will be able to take action to alleviate the problem and make our community a healthier place to live. As citizens and consumers we can recycle; reduce our consumption of non-recyclable, highly packaged, and wasteful products; demand legislation requiring recycling, bottle bills, stronger environmental regulations regarding consumer products and their disposal; and adjust our lifestyles so that we have less impact on the environment. Through our daily lives, we are responsible for the production of solid waste, so we must work together to solve the problem.

How To Use This Curriculum

The North Carolina Solid Waste Reduction Curriculum has been designed by teachers for teachers to help inform our students about the issue of solid waste and its reduction and disposal concerns. The curriculum is organized to meet the needs of reducing our solid waste stream and to correlate with the goals and objectives found in the North Carolina Standard Course of Study. It is the hope of the authors that teachers will use this curriculum, not only because it addresses a very important societal problem, but also because it meets state requirements and is relevant to everyone's daily life.

This curriculum was designed as an integrated model. It has been correlated to the most recent edition of the Teacher Handbook for each subject area. Each activity addresses several subject areas, as noted in the upper right hand corner by subject area symbols. At the beginning of each grade level, all activities are listed along with page numbers and integrated subject areas.

Symbol	Subject Area	NC Teacher Handbook Curriculum Year
	Communication Skills	1992
	Math	1990
	Science	1994
	Social Studies	1991
	The Arts	1988

The curriculum is broken down into three grade spans: kindergarten through grade two, grades three through five, and middle grades, 6-8. For each grade span, a series of activities has been developed around four major topics related to solid waste. These topics are:

1) 3 R's (Reduce, Reuse, Recycle)
2) Packaging
3) Waste Disposal
4) Natural Resources

These actvities were selected from numerous resources to incorporate all the major issues regarding solid waste, while meeting the goals and objectives of the North Carolina Standard Course of Study. Each activity was chosen and designed to be both interesting and educational. The activities include all background information necessary for anyone to teach the concepts with a minimum of preparation and prior knowledge of solid waste. Each curriculum contains a detailed glossary of terms, a bibliography of materials and information sources, and a listing of additional sources for more activities and educational materials related to this subject.

KINDERGARTEN

TITLE	MAJOR TOPIC	PAGE NO.	SUBJECT AREAS COVERED
Worm Formation	*3 R's*	*K.1*	💡
What's In A Bag	*3 R's*	*K.2*	📝 💡
Eggsactly What's The Best	*NATURAL RESOURCES*	*K.4*	🧩 📝 💡
It's Natural	*NATURAL RESOURCES*	*K.5*	🧩 📝 💡 👥
Enough Is Enough	*PACKAGING*	*K.6*	⚖ 📝 🧩
Life In A Fish Bowl	*WASTE DISPOSAL*	*K.8*	💡 👥 🧩
Get It Together	*WASTE DISPOSAL*	*K.10*	💡 🧩

3 R's

Worm Formation

Grade Level : K

Subject:
Science 2.1

Time:
one class period

Setting:
classroom

Materials:
shallow container, black paper or cardboard, moist paper towel, a flashlight, at least one live red worm (the red worm, latin name *eisenia foetida*, can be ordered from a biological supply company, purchased at a bait shop, or possibly found in your garden)

Skills:
observing, predicting

Vocabulary:
red worm
senses
vermicomposting

Source:
Worms Eat My Garbage
Mary Applehoff
1993 Flower Press

Summary: The children will learn if worms are sensitive to light.

Objective: To observe the behavior of a worm when it is exposed to light.

Background: Even though worms are usually drawn with eyes, they don't have eyes as we do.

Leading Question: Do worms sense light?

Procedure:

1. Place moist paper towel in a shallow container.
2. Cover half the container with cardboard or black paper.
3. Put the worm in the uncovered part of the container.
4. Shine the flashlight on the worm.
5. Discuss what the worm did and why.

What Now?

1. Set up a classroom vermicomposting container.
2. Put a layer of soil on the bottom of a container - old aquariums work well. Add aeration holes if possible or use recycling bins. Container should have a lid to keep out the light. If using glass, then blacken three sides. Use shredded newspaper as bedding.
3. Add worms, leaves, and grass clippings, burying them approximately one inch beneath the surface.
4. Keep the vermicompost moist, but not too moist because worms breathe through their skin. Spray bottle works well.
6. Add the castings to a school or class garden.

What's In A Bag?

Grade Level : K

Subject:
The Arts 3.1
Science 4.2

Time:
one class period or whatever will work best for your class.

Setting:
classroom

Materials:
one large paper grocery bag for each child, markers or paint, crayons, yarn, scraps of construction paper
Poem: "Yesterday's Paper"

Skills:
observing, analyzing

Vocabulary:
cycle
recycle

Source:
Action for a Cleaner Tomorrow
South Carolina Dept. of Health and Environmental Control.

Summary: The children will create animals out of brown paper grocery bags which they have brought from home. You may have to collect brown grocery bags yourself since so many people choose plastic over paper.

Objective: The children will learn how to reuse a paper bag.

Background: A cycle is something that continues forever. To recycle is to imitate nature by taking a piece of trash and turning it into something else that is usable.

Leading Question: Can we do something else with this bag instead of throwing it away?

Procedure: This will work best in a small group setting.

1. Show some examples of bags being made into something else.
2. Pass out a bag to each child.
3. Let each child decide what he/she wants to make and allow a reasonable amount of time to make it.

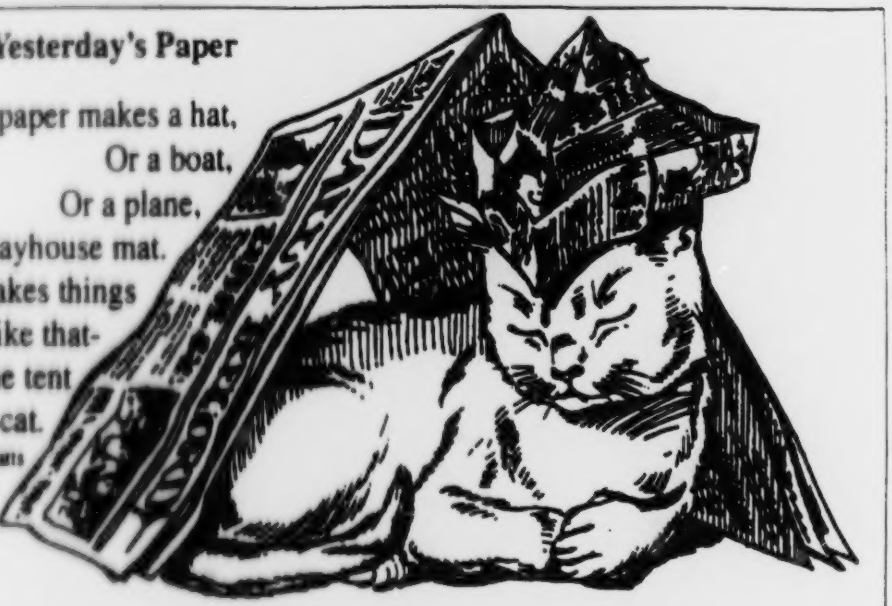
What Now?

1. Parade through school on Earth Day or any day in the reused costumes.
2. Memorize "Yesterday's Paper" to share with other groups of young children.
3. Brainstorm uses for old newspaper.

Yesterday's Paper

Yesterday's paper makes a hat,
Or a boat,
Or a plane,
Or a playhouse mat.
Yesterday's paper makes things
Like that-
And a very fine tent
For a sleeping cat.

Mabel Watts



NATURAL RESOURCES

Eggsactly What's The Best?

Grade Level : K

Subjects:
Social Studies 8.5
The Arts 2.4
Science 2.4, 2.1

Time:
one class period

Setting:
classroom

Materials:
an egg carton for each child

Skills:
observing, comparing, analyzing

Vocabulary:
Styrofoam
polystyrene
waste paper
reusable
choice
biodegradable
renewable
non-renewable resource

Source:
Watauga County Recycling Curriculum Committee

Summary: The children will compare a Stryrofoam egg carton with a paper egg carton noting obvious differences. They will use the egg cartons in an art activity.

Objective: Children will learn that some packaging is better for the environment than others and that they can learn to make choices when buying that will help the environment.

Background: Paper egg cartons are made from waste paper whereas Styrofoam egg cartons are made from non-renewable fossil fuels - Styrofoam is a trade name for polystyrene which is used to make cups, fast food containers, household items, and packaging materials.

Leading Question: Is some packaging better than others?

Procedure:

1. Seat children in a circle. Pass around a Styrofoam egg carton and a paper egg carton letting each child examine it using their senses of touch, smell, and sight.
2. Note characteristics and record on a chart.
3. Brainstorm ways to reuse the cartons - record their ideas on another chart.
4. Tell children the differences they don't immediately notice - such as one is Styrofoam and one is paper and one is made from a non-renewable resource and one is made from recycled products. Discuss the properties of each.
5. Ask the children which might be the better buy and why.

Second class period:

Give each child an egg carton to make into something new. Choose something from the list of brainstormed ideas.

What Now?

1. What egg carton should we use?
2. What are paper egg cartons made from?
3. What are Styrofoam egg cartons made from?
4. Set up a choice table with the following items displayed:
   paper napkin, cloth napkin
   paper cup, plastic cup
   plastic milk jug, cardboard milk carton
   ice cream cone, ice cream in a cup with a spoon
   catsup in a plastic bottle, catsup in a glass bottle.

Let children decide which choice is best, drawing their responses on recycled paper. They can share their choices and tell why they made them.

K.5

NATURAL RESOURCES

It's Natural

Grade Level : K

Subjects:
Social Studies 8.5
The Arts 2.1
Science 4.2, 2.1, 2.2, 2.6, 2.7
Communication Skills 1.3

Time:
forty minutes

Setting:
classroom

Materials:
examples of natural resources: sand, wood scraps, glass container, paper products, oil, aluminum cans, plastic products, baby food jars, glass bottles, trash can.

Skills:
observing, classifying, predicting, inferring

Vocabulary:
natural resource
landfill
aluminum
plastic

Sources:
AVR Teacher's Resource Guide
Association of Vermont Recyclers.

Pennsylvania Recycling and Waste Reduction Curriculum Activity
Pennsylvania Dept. of Education.

Summary: Using examples of natural resources, the children will classify everyday items into one of the natural resources.

Objective: Children will understand what natural resources are and realize the limited availability of these resources.

Background: Everything we make, use, and throw away comes from the earth.

Leading Question: Where do the things we use come from?

Procedure:

1. Show the class examples of natural resources such as wood, sand, coal, soil, rocks, oil, water, salt, gold (a rock painted gold). Let the children handle the items. Ask them where these things come from. Introduce the term "natural resource" as anything in our world not made by people or machines.
2. Distribute items or pictures of things made from natural resources. Let each child classify his/her item or picture by putting it on a piece of cardboard (natural resources classification board) depicting one of the natural resources.
3. Have each child fill a baby food jar with sand and then dump the jar in a box labeled "landfill." After all the jars have been dumped, ask what will happen to the landfill if we continue to throw away our natural resources. What will happen to our natural resources?

4. Using the natural resources classification board students have constructed in the above procedure, ask the children what can be used instead. For example, instead of using paper napkins or paper towels we can use cloth ones and so on.

What Now?

1. Read: *The Lorax* by Dr. Seuss. Discuss what happens when a natural resource is used up and how we can do things differently to keep this from happening.

2. Plant a tree on the school grounds and/or let each child start a tree in the classroom to plant at his/her home.

3. Show the class how natural resources can be recycled into different new products - for example, a newspaper becomes a cereal box.

PACKAGING

Enough Is Enough

Grade Level : K

Subjects:
Math 3.5
The Arts 3.4
Social Studies 8.5

Time:
one class period

Setting:
classroom

Materials:
enough packages of sugarless gum for each child to have one piece

Skills:
counting, hypothesizing, deductive thinking, classifying

Vocabulary:
packaging
trash
natural resources

Sources:
A-Way With Waste
Washington State
Department of Ecology

AVR Teacher's Resource Guide
Association of Vermont
Recyclers.

Summary: Children will examine over-packaging using gum wrappers.

Objective: Children will become aware of excessive packaging and explore different buying choices.

Background: Much of what we buy is packaged for freshness and safety. However, much of what we buy is packaged excessively. Most of this excess packaging cannot be recycled and therefore ends up in our landfills.

Leading Question: What effect will one gum wrapper have on our landfill?

Procedure:
With the children seated in a circle, recite from a chart the poem "How The Trash Pile Grows."

How The Trash Pile Grows
Buy it,
Try it,
Throw the Trash away!
Take it,
Break it,
Throw the Trash away!
Get it
Use it
Finish it
Lose it
Wear it
Tear it,
Throw the Trash away!
Soda pop,
Box top,
Once you start, you can't stop.
Buy it,
Show it,
Nothing left but throw it.
Throw the Trash away!
(Oh, nowhere is "away!")

Betty Miles, *Save the Earth an Ecology Handbook*

1. Distribute a piece of gum to each child.

2. Tell the children to unwrap the gum carefully so the wrapper(s) are not torn. You may need to help the children with this.

Enough Is Enough(Continued)

3. Classify the wrappers by kind, putting them on a chart or poster in sets of 5 or 10 so they can be easily counted.

4. Estimate the number of wrappers.

5. Talk about the number of wrappers and why there are so many.

6. Discuss with the children other kinds of packaging. Think of different products that have more than one layer of packaging.

7. Ask the children what they think will happen to our landfills if all the excess packaging keeps getting thrown into the landfill.

What Now?

1. Discuss ways to reduce the amount of packaging on certain items such as individually wrapped cheese slices.

2. Talk about foods they like to eat and some they don't, and discuss the food's packaging.

3. Show the children how to look for recycled content products.

4. Purchase some gum with edible wrappers, if available in your county.

WASTE DISPOSAL

Life In A Fish Bowl

Grade Level : K

Subjects:
Science 2.1, 2.7
Communication Skills 2.1, 2.2
Social Studies 8.5

Time:
thirty-five to forty minutes

Setting:
classroom

Materials:
glass fishbowl or large jar, fish made from plastic meat tray, overhead projector or flashlight, 8 film canisters with tops containing soil, sand, liquid dish detergent, chocolate syrup, salt, shredded paper, powered detergent, hot water, red food coloring

Skills:
observing, predicting, letter writing

Vocabulary:
eroding (erosion)
pollution
fertilizer
decompose

Source:
Action for a Cleaner Tomorrow
South Carolina Dept. of Health and Environmental Control

Summary: Children will create a lake in a gallon-sized glass jar and litter it with the items found in each of the film canisters.

Objective: The children will understand the effects of pollution on living things.

Background: Our waterways are infested with litter. This litter affects the quality of our lakes, streams, rivers, and oceans. As a result, our quality of life is also affected.

Leading Question: What happens to the creatures living in our rivers and streams when these bodies of water become polluted? What can happen to us if we fish in these polluted bodies of water?

Procedure:

1. To demonstrate what happens to a fish when a river becomes polluted, create a friendly fish character and a river to bring the story to life. Students can name the river and the fish.
2. Make the fishbowl river from a glass or soft drink bottle or any similar container. Make the fish from a reused, clean meat tray or any other waterproof item.
3. Read the narrative attached, adapting it to the age of the children.
4. As you read, ask different children to add the ingredients in the film canisters as indicated to represent pollution.
5. Discuss what can be done.
6. Have children draw two pictures of a river before cleanup and after cleanup.
7. Have children make a class chart of things that pollute our rivers.

What Now?

1. Write letters to civic groups asking them to donate pitch-in containers which can be placed along the streams and rivers in your county. Be sure to obtain permission from the proper authorities. Decide who will empty these.
2. Participate in North Carolina's Annual Big Sweep in September of each year. For information, call (919) 828-6686.
3. View the 17-minute video *The Death of a Whale*, the story of a sperm whale stranded on Wrightsville Beach in 1992 which probably died of plastic ingestion. The video may be purchased from Environmental Media, P.O. Box 1016, Chapel Hill, NC 27514. FAX: (919) 942-8785. (Price: $9.95 + S&H for NC teachers.) Another video called *Inky* is about a pygmy sperm whale who is suffering from plastic ingestion. This video has a happy ending. *Inky* runs 15 minutes and can be purchased for $4.00 from Jennifer Fasik (National Aquarium) at (410) 576-3860.

NARRATIVE: Imagine a river as it meanders through the countryside, past the farmers' fields, widening into a lake, but narrowing again as it passes through the city. In this river, named __________ lives a fish. Its name is __________. *(Point to the fish in the clear water in the fishbowl.)* **ASK: HOW DOES IT FEEL TO BE THIS FISH?** *(This question should be asked repeatedly throughout the story and should generate an enthusiastic response from your students. Let students respond aloud.)*

The fish swims down river past an **eroding** bank. An eroding bank is where soil sometimes washes into the river. When it rains, what will happen to the bank? What if it rains a great deal? *(Have student pour soil from the container into the water.)* **ASK: HOW DOES IT FEEL TO BE THIS FISH?**

Suppose part of the soil eroding into the water came from farmland. The farmer has just put fertilizer on the field. Instead of staying on the field to help the crops grow, some of the **fertilizer** may ride "piggy-back" on the eroding soil and go into the river. *(Add sand to simulate fertilizer.)* What effect will the fertilizer have on the plants in the river? *(It will make plants grow.)* If the plants grow too abundantly and too fast, the river can't continue to support them. They die, fall to the bottom, and start to **decompose**.

Decomposing things use oxygen. What else in the river needs oxygen? *(The fish.)* **ASK: HOW DOES IT FEEL TO BE THIS FISH?**

Farm fields aren't the only source of fertilizer that can flow into a river. Homes may also be a source. Where the river has widened into a lake, several families have built their homes. Perhaps their septic tanks drain into the water or some of the fertilizers they've put on their lawn have washed into the water. *(Add liquid dish detergent to represent **pollution** from homes.)*

As the lake narrows back into a river, our fish continues downstream past the city. Even though the city people don't pollute the water directly, what they do at their own homes or subdivisions can affect the quality of the river's water. Have you ever seen a car leaking oil? Where does the rain wash this oil? *(Put chocolate syrup, representing oil, into the fish bowl.)* **ASK: HOW DOES IT FEEL TO BE THIS FISH?**

In the winter, when it gets icy and snows, what do we put on our roads to make it easier to drive? *(Salt or sand. Put salt into the water.)* When you eat or drink something salty, what do you do? *(You get something else to drink.)* Can this fish get fresh water to drink? *(No.)* **ASK: HOW DOES IT FEEL TO BE THIS FISH?**

Suppose the city has a park next to the river. People litter the park and some of it blows into the water. *(Put pieces of paper into the fish bowl.)* **ASK: HOW DOES IT FEEL TO BE THIS FISH?**

As the river leaves the city, there are several factories that are located along it. Although regulations are strict, if the factory's control equipment is not working properly, some chemicals or heated water may flow into the river. *(Put powdered detergent and hot water into the fish bowl and stir for effect.)*
ASK: HOW DOES IT FEEL TO BE THIS FISH?

WASTE DISPOSAL

Get It Together

Grade Level : K

Subjects:
Science 2.2
Social Studies 1.3

Time:
one class period - 30 minutes

Setting:
classroom

Materials:
illustrations depicting managing choices, poem "Sarah Cynthia Sylvia Stout"

Skills:
classifying, problem solving

Vocabulary:
manage
management
choice

Source:
Watauga County Recycling Curriculum Committee

Summary: The children will classify illustrations depicting management choices into good management and bad management.

Objective: The children will become aware of management choices and relate these choices to waste management.

Background: We are faced with management choices everyday — how to manage our time, our budget, ourselves, our garbage. Managing our garbage is an ongoing problem. While many old landfills are either at capacity or closing due to new regulations, we continue to produce more and more products that cannot be recycled or even reused.

Leading Question: How does being a good manager make life easier for us?

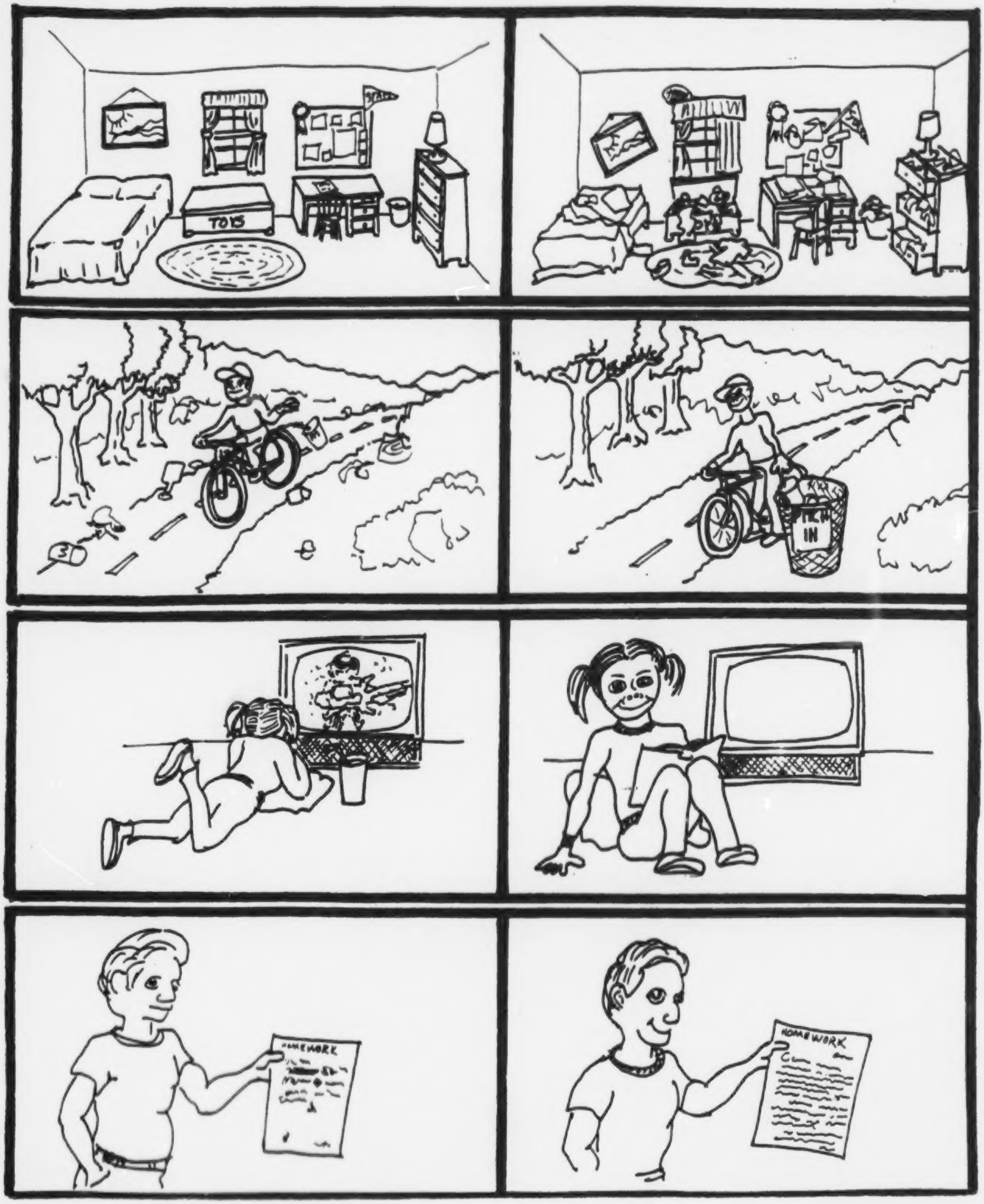
Procedure:

1. Introduce the word "manage." Brainstorm or web the children's ideas about management.
2. Discuss the illustrations depicting management choices. A clean room versus a messy room, garbage thrown into the river or roadside versus garbage put into the garbage can, garbage being hauled to the landfill or garbage being recycled.
3. Classify the illustrations into good and bad management choices.
4. Read and discuss "Sarah Cynthia Sylvia Stout" by Shel Silverstein.
5. Ask why it is important to be good managers of the earth.
6. Have children draw their own example of a good management choice they have made.

What Now?

Begin a home recycling project in an attempt to become good managers of garbage.

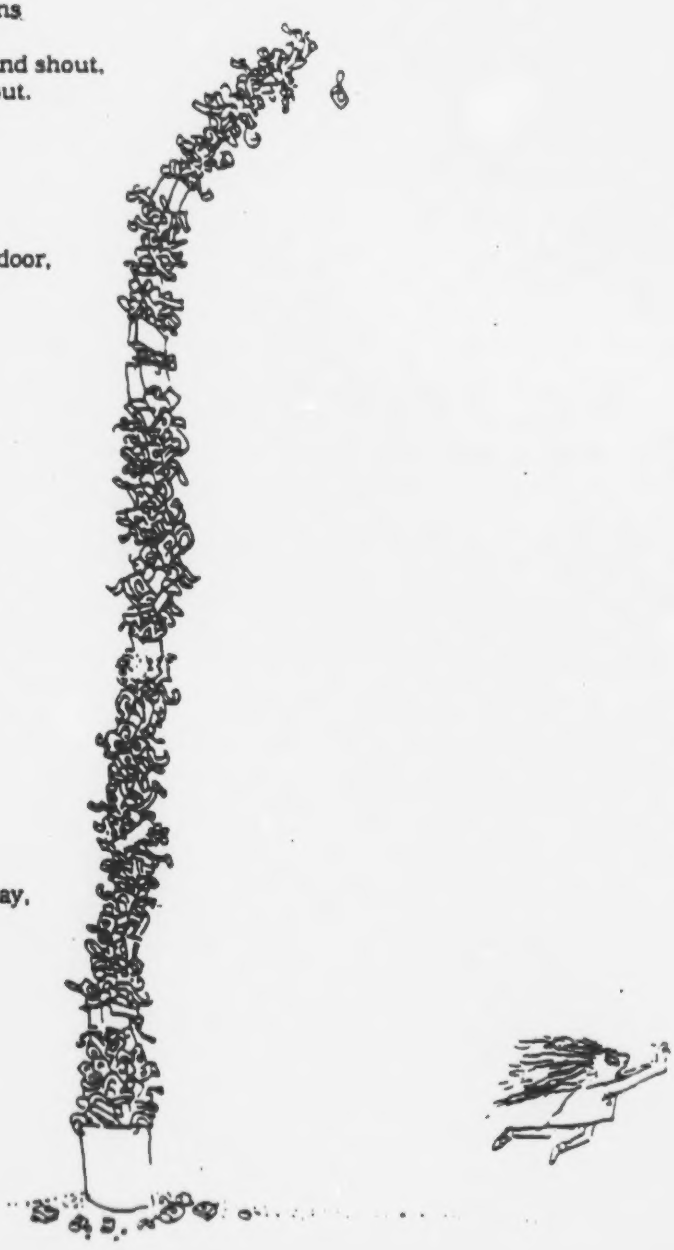
"Get It Together"


TOYS
PITCH IN
HOMEWORK
HOMEWORK

SARAH CYNTHIA SYLVIA STOUT

by Shel Silverstein

Sarah Cynthia Sylvia Stout
Would not take the garbage out.
She'd wash the dishes and scrub the pans
Cook the yams and spice the hams,
And though her parents would scream and shout,
She simply would not take the garbage out.
And so it piled up to the ceiling:
Coffee grounds, potato peelings,
Brown bananas and rotten peas,
Chunks of sour cottage cheese.
It filled the can, it covered the floor,
It cracked the windows and blocked the door,
With bacon rinds and chicken bones,
Dripply ends of ice cream cones,
Prune pits, peach pits, orange peel,
Gloppy glumps of cold oatmeal,
Pizza crusts and withered greens,
Soggy beans, and tangerines,
Crusts of black-burned buttered toast,
Grisly bits of beefy roast.
The garbage rolled on down the halls,
It raised the roof, it broke the walls,
I mean, greasy napkins, cookie crumbs,
Blobs of gooey bubble gum,
Cellophane from old bologna,
Rubbery, blubbery macaroni,
Peanut butter, caked and dry,
Curdled milk, and crusts of pie,
Rotting melons, dried-up mustard,
Eggshells mixed with lemon custard,
Cold French fries and rancid meat,
Yellowed lumps of Cream of Wheat.
At last the garbage reached so high
That finally it touched the sky,
And none of her friends would come to play,
And all the neighbors moved away;
And finally, Sarah Cynthia Stout
Said, "Okay, I'll take the garbage out!"
But then, of course, it was too late,
The garbage reached across the state,
From New York to the Golden Gate:
And there in the garbage she did hate
Poor Sarah met an awful fate
That I cannot right now relate
Because the hour is much too late
But children, remember Sarah Stout,
And always take the garbage out.



FIRST GRADE

TITLE	MAJOR TOPIC	PAGE NO.	SUBJECT AREAS COVERED
What's A Cycle	3 R's	1.1	💡 🧩
The Banana Peel Blues	3 R's	1.4	👥 💡 🎨
What's Recyclable?	3 R's	1.7	💡
Renuzit - Part A	3 R's	1.8	💡
Renuzit - Part B	3 R's	1.9	💡 🧩 🎨
Trash To Treasure	3 R's	1.11	💡 👥 ⚖
Barter Day	3 R's	1.12	🧩 👥
Old Toys	NATURAL RESOURCES	1.17	👥 🧩 💡
Bag Lunch	PACKAGING	1.18	💡 🧩
The Turtle's Mishap: A Puppet Show	WASTE DISPOSAL	1.19	🎨 💡 🧩
NoWhere Is Away	WASTE DISPOSAL	1.25	👥 💡 🧩 🎨
It's Hot In Here!	WASTE DISPOSAL	1.29	💡 🧩

What's A Cycle?

Grade Level : 1

Subjects:
Science 2.1, 2.2, 2.7
Social Studies 8.5

Time:
one class period

Setting:
classroom

Materials:
chart paper, old magazines, glue, scissors, posterboard, recycling logo, "Save! Sort! Recycle!" worksheet, "cans" made from cardboard or tagboard

Skills:
classifying, observing, predicting

Vocabulary:
cycle
recycle

Source:
Action for a Cleaner Tomorrow
South Carolina Dept. of Health and Environmental Control

Summary: The children will brainstorm the cycles they know about (day/night, butterfly, tree, seasons). They will choose a cycle to illustrate. It could even be a picture of their day.

Objective: The children will become aware of cycles to help them understand recycling.

Background: Through recycling, the amount of solid waste produced can be greatly reduced. See "Recycle Cycle" sheet in appendix.

Leading Question: What's a cycle?

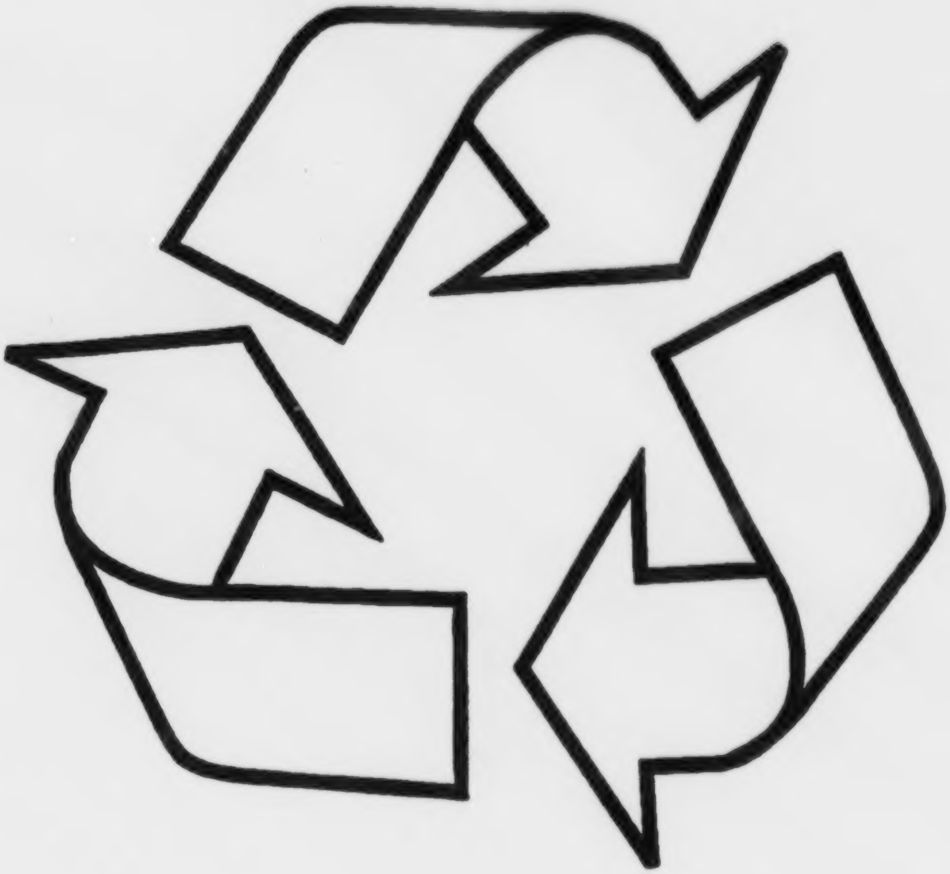
Procedure:

1. Brainstorm different cycles the children know about.
2. How is a cycle like a wheel?
3. Introduce the term recycle - Ask the children what they think it means.
4. Ask if they reuse and recycle things at their home. For example: a toilet paper roll becomes a holder for an extension cord. Ask: Do you buy toliet paper with recycled content? What about your cereal boxes? Are they gray? If they are, then they are made from recycled paper.

What Now?

1. Color the recycling logo. Copy on backside of already used paper, if possible.
2. Cut out pictures from old magazines of things that can be recycled. Use these pictures for the activity, "What's Recyclable?"
3. Make copies of the "Save! Sort! Recycle!" worksheet for each child. Have the children color the pictures, cut them out, and glue them on the appropriate can - reuse or recycle.
4. Laminate the worksheet and do this as a whole group activity.
5. Have students make a "How to Recycle" book to take home. These books can be made from the bottoms of brown grocery bags.
6. Share the "Save! Sort! Recycle!" activity with the class. You may want to laminate the worksheet for permanent use.

1.2

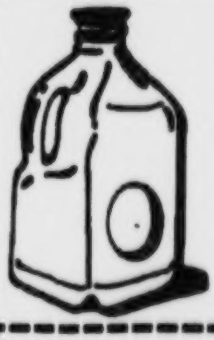
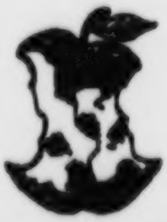
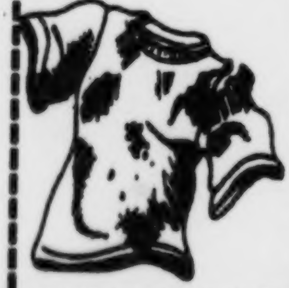
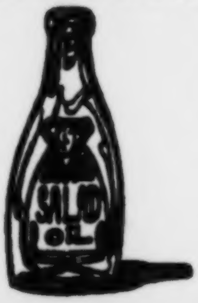


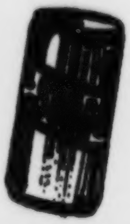
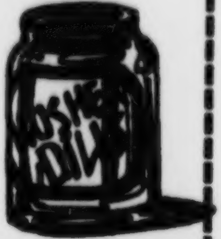
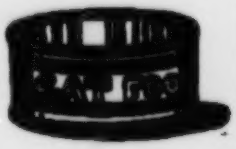
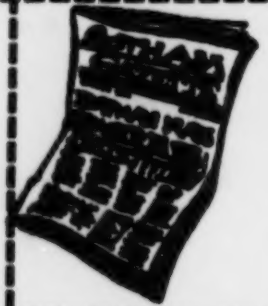
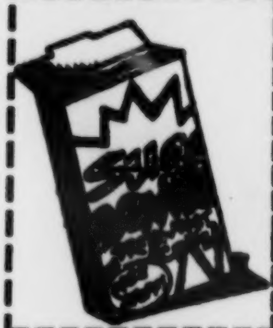
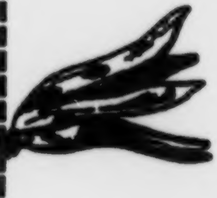
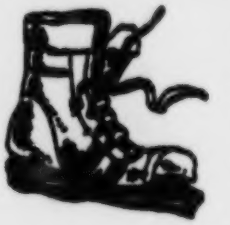
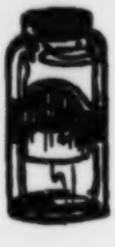
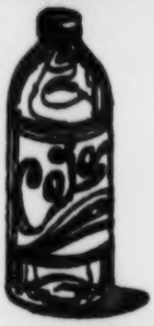
Recycle

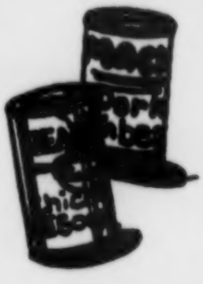
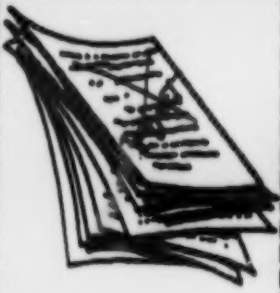
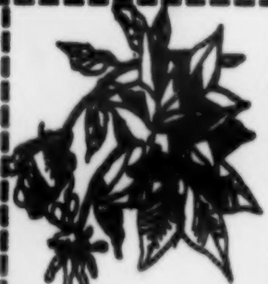
1.3

SAVE! SORT! RECYCLE!

Color the recyclable items on this page. Then cut them out and paste them onto the proper recycling "cans." (Option: Have students divide real items shown on the handout into appropriately labeled boxes.)

The Banana Peel Blues

Grade Level : 1

Subjects:
Communication Skills 2.1
Science 3.5, 4.2
The Arts 1.3

Time:
three thirty-minute class periods

Setting:
classroom

Materials:
wormbox materials (directions are on page 2.5)
Song - "The Banana Peel Blues" - page 1.5,
recipe for compost pile cake - page 1.6

Skills:
sequencing, cause and effect

Vocabulary:
vermicompost
humus
microbes
castings

Source:
AVR Teacher's Resource Guide
Association of Vermont Recyclers.

Summary: The children will learn the art of composting through the song "The Banana Peel Blues."

Objective: The children will learn how to set up a wormbox including kinds of organic waste that are appropriate for the wormbox. They will understand the cycle of vermicomposting. Students will also see how composting works to decompose organic matter in contrast to vermicomposting.

Background: Learning to manage solid waste is essential if we are going to continue to depend on landfills to handle the garbage that cannot be recycled or reused. Vermicomposting is one alternative to organic waste disposal. It is different from composting because it uses worms (red worms) which eat the dirt in the compost and enrich the soil through their castings. A compost pile produces heat from microbes decomposing organic material. For the classroom, a contained wormbox pile works best. You may want to have both a wormbox for vermicomposting and a box for regular composting.

Leading Question: What is vermicomposting?

Procedure:

1. Sing "The Banana Peel Blues" to the tune "Take Me Out To The Ballgame" with the children. (See page 1.5)
2. Discuss the sequence of events leading up to the production of humus.
3. Make a chart of things that can be vermicomposted (no meat or dairy products).
4. Discuss what kinds of things are needed to help the food scraps, etc. break down and make new soil (air, water, worms, microbes).
5. Discuss one of the following questions on subsequent days.
    a. Why is a food grinder or blender helpful?
    b. What do microbes do?
    c. How does the production of humus start the cycle of soil over again?
6. Put the song on sentence strips. Scramble the strips up and let the children take turns putting the song in order

What Now?

1. Set up a wormbox at school.
2. Send directions for a wormbox home with each child so that home vermicomposting can begin.
3. Begin to collect appropriate vermicomposting materials for the wormbox. If you set up a compost pile as well, choose different groups of children to add food scraps from lunch to the compost pile.
4. Make a compost pile cake (see attached recipe).

Banana Peel Blues

Take me out to the compost;

Take me out to the heap.

Grind me up in a food grinder;

I don't care if I'm chopped in to bits,

'Cause it's root root root for the microbes;

If they don't live it's a shame.

For it's 2, 4, 6 weeks I'm out to the old garden.

It's Fun To Make A Compost Pile Cake!

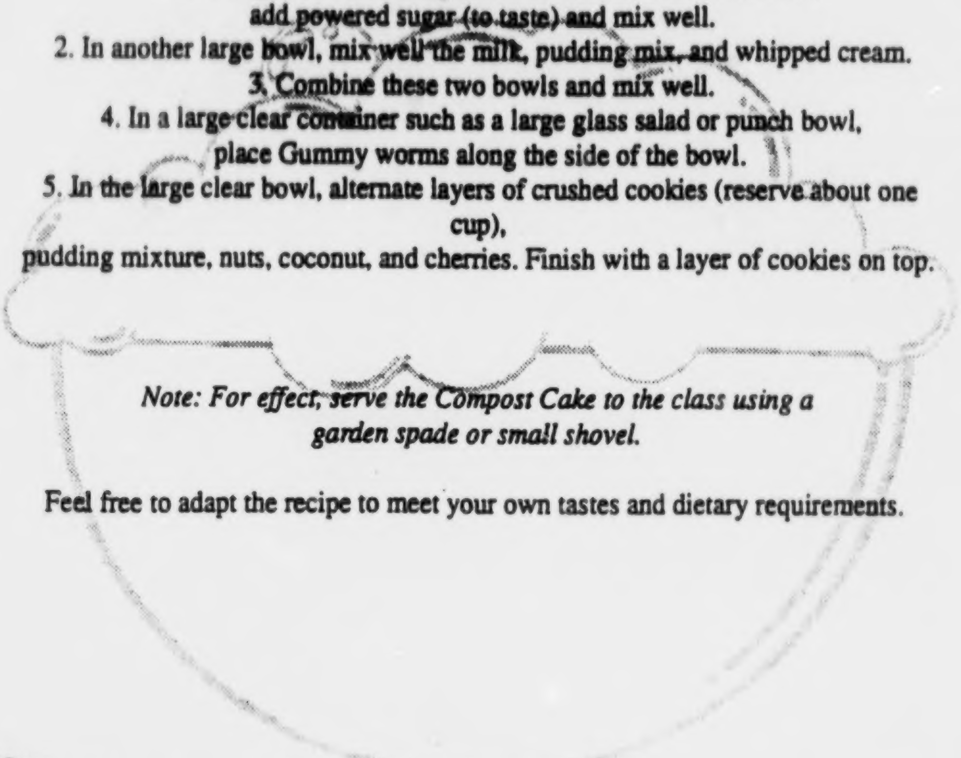
As an extension activity, have students bring in ingredients and help prepare **A Compost Pile Cake.**

Ingredients:

3 1/2 cups Milk
1/2 cup Margarine
12 ounces Prepared Whipped Cream topping
8 ounces Cream Cheese
1 cup Powdered Sugar
one 20 ounce package of Chocolate, Vanilla Cream-filled Sandwich Cookies (crushed to simulate dirt)
two 3.4 ounce packages of Vanilla Instant Pudding
six Gummy Worms (any flavor will do)
1 cup chopped nuts (pecans or walnuts)
1 cup chopped maraschino cherries
1 cup coconut (you may want to use green food coloring to simulate grass clippings)

How to prepare:

1. In a large bowl mix margarine and cream cheese until soft, add powered sugar (to taste) and mix well.
2. In another large bowl, mix well the milk, pudding mix, and whipped cream.
3. Combine these two bowls and mix well.
4. In a large clear container such as a large glass salad or punch bowl, place Gummy worms along the side of the bowl.
5. In the large clear bowl, alternate layers of crushed cookies (reserve about one cup), pudding mixture, nuts, coconut, and cherries. Finish with a layer of cookies on top.



Note: For effect, serve the Compost Cake to the class using a garden spade or small shovel.

Feel free to adapt the recipe to meet your own tastes and dietary requirements.

What's Recyclable?

Grade Level : 1

Subject:
Science 2.2, 4.31

Time:
two class periods

Setting:
classroom

Materials:
posterboard, magnets, scissors, glue, pictures saved from "What's A Cycle" activity

Skills:
classifying, observing, communicating

Vocabulary:
recyclable
aluminum

Source:
Watauga County Recycling Curriculum Committee

Summary: The children will discuss their pictures from "What's A Cycle" and create a collage with them.

Background: Most everything can be recycled in some way. Some materials are more easily recycled than others and some can be recycled but are not collected in our area. North Carolina prohibits disposal of various materials in landfills, including aluminum cans.

Leading Question: What things can be recycled?

Procedure:

1. Different items are recycled in different areas. These include the following: newspaper, plastic milk jugs, (#2HDPE) cardboard, cereal boxes, glass (clear, brown, or green), cans (aluminum and bi-metal), and clear plastic drink bottles (#1 PET). Find out what is recycled in your area.
2. Each child will look for pictures in old magazines of things that can be recycled or use the "saved" pictures from the "What's A Cycle" activity.
3. The children will explain to the class why these items can be recycled and will then put them in a collage of recyclable materials.

What Now?

1. Center activities. Have children separate aluminum cans from bi-metal cans using a magnet. Note other differences between the two types of cans.
2. Have each child make a *How to Recycle* book to take home. Be sure to use paper that has already been used once for this activity. For example - the books could be made out of brown grocery bags or from paper which has only been used on one side. Include in the book things that can be recycled and how they must be prepared for recycling.
3. Set up a recycling center in your classroom.
4. Make some paper using construction paper scraps. Mix ingredients according to the directions from "Everything Old is New Again" activity. Using open-type cookie-cutters, pour the pulp into the mold. Let the children gently press the excess water out of the pulp. Add more pulp as needed to make a sturdy, stand-up character. This activity can be integrated into a particular unit of study, such as the rainforest, dinosaurs, plants, etc.

3 R's

Renuzit **Grade Level : 1**

Part A

Subject:
Science 2.2, 2.7

Time:
one class period

Setting:
classroom

Materials:
clean trash collected from children's homes, 3 boxes labeled "reuse," "reduce," and "recycle"

Skills:
classifying, predicting, problem solving, advertising

Vocabulary:
reduce
reuse
recycle
trash
solid waste

Source:
All "Trashed" Out, Illinois Department of Energy and Natural Resources

Summary: The children will bring in "clean" trash. They will classify the trash into piles of reduce, reuse, and recycle. Allow time for the children to give an explanation as to why they chose to put the trash in the pile they did.

Objective: The children will be able to determine which items of trash can be reduced, reused, or recycled.

Background: The average North Carolina citizen throws away 5.6 pounds of garbage a day. Most of what is thrown away could be recycled.

Leading Question: What kinds of things do you throw away that could be reused or recycled? Could you stop using some things altogether?

Procedure:

1. Have children bring in some "clean" solid waste.
2. Collect the solid waste in a corner of the room.
3. When you get ready to work with this activity, seat the children around the pile of solid waste. Have each child choose some trash to classify. After all pieces have been classified and put in the appropriate box - reduce, reuse, recycle - set the stage for next activity by asking: How can we reduce, reuse, and recycle this trash?

What Now?

1. Discuss the use of natural resources in the production of the items collected in the above procedure. What impact has this production had on the environment?
2. Ask students to tell about their favorite animal. Has the production of the solid waste items been harmful to these animals? How?

3 R's

Renuzit

Grade Level : 1

Part B

Subjects:
Science 2.2
Social Studies 8.5
The Arts 2.3

Time:
one or two class periods

Setting:
classroom

Materials:
bottoms of brown paper grocery bags, one per child; tape, stapler, glue, or hot glue gun; yarn; hole punch; large-eyed needles
"Johnny" by Marci Ridlon
"Yesterday's Paper" by Mabel Watts

Skills:
problem solving, critical thinking, classifying

Vocabulary:
earth quilt

Source:
Watauga County Recycling Curriculum Committee

Summary: The children will create an earth quilt using trash and showing ways to reuse, reduce, or recycle that trash.

Objective: The children will realize that becoming responsible shoppers and consumers can greatly reduce the amount of trash in their lives and in the landfill.

Background: Many old landfills are near capacity and many have had to close because of leachate contaminating groundwater.

Leading Question: What are some ways we can get rid of this trash without taking it to the landfill?

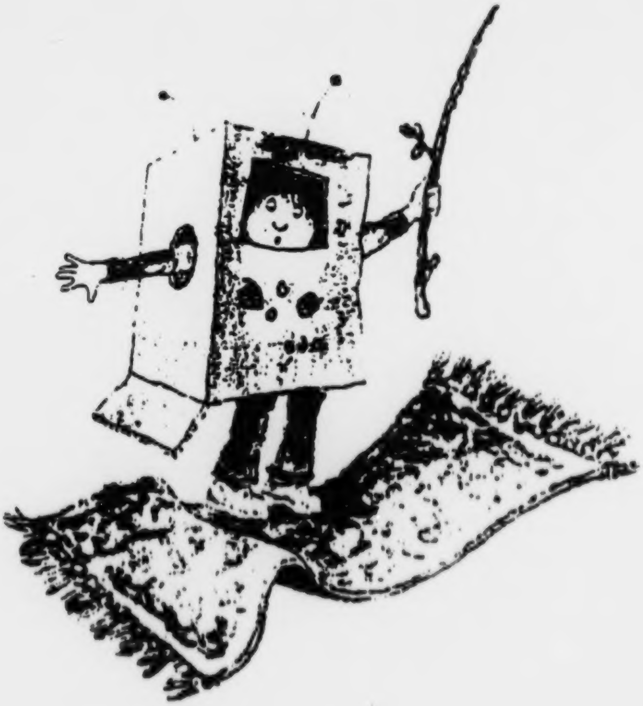
Procedure:

1. Read the poems "Johnny" by Marci Ridlon and "Yesterday's Paper" by Mabel Watts to the children.
2. Discuss the different ways "junk" has been used in these poems.
3. Prepare a "quilt" using the bottoms of a paper grocery bag. Secure the pieces together with strong masking tape. Tape the back as well or yarn the pieces together. To do this, pre-punch the holes along the sides and ends of the bag. With help, the children can then sew them together.
4. During an art center time, each child will choose a piece of trash and figure out another use for it. They will attach the trash to their panel leaving space to draw or write the new uses of the trash. The child writes on the pane: reduce, reuse, or recycle. Use the clean solid-waste collected for Part A of this lesson.

What Now?

1. Plan art activities around student's ideas for reuse of solid waste items and incorporate these projects for use in the curriculum throughout the year.
2. Have students discuss the reuse of materials with parents and grandparents, then report this to the class.

Renuzit - Part B (continued)



JOHNNY

To Johnny a box
is a house
or a car
or a ship
or a train
or a horse.
A stick
is a sword
or a spear
or a cane,
and a carpet
is magic,
of course.

Marci Ridlon

Yesterday's Paper

Yesterday's paper makes a hat,
Or a boat,
Or a plane,
Or a playhouse mat.
Yesterday's paper makes things
Like that-
And a very fine tent
For a sleeping cat.

Mabel Watts

Trash To Treasure

Grade Level : 1

Subjects:
Science 2.2
Communication Skills 2.1, 2.2
Math 4.8, 4.9

Time:
two class periods or more if needed

Setting:
classroom

Materials:
clean garbage

Skills:
classifying, counting money

Vocabulary:
reuse
recycle

Source:
Watauga County Recycling Curriculum Committee

Summary: The children will bring in some "clean" garbage. They will design new items from the "garbage" brought in and have a trash to treasure sale featuring their new designs.

Objective: The children will begin to think of ways to reduce, reuse, and recycle.

Background: Most of what we use gets thrown away as soon as we are finished with it. Most trash ends up in landfills where it takes up space. Many times these items could be reused to reduce the waste stream from our schools and communities.

Leading Question: What can we do with all this garbage?

Procedure:

1. Collect clean garbage for several days. Stack it in a corner of the classroom.
2. Observe the pile as it grows, referring to it as the landfill.
3. A few days before the junk sale, separate the garbage according to reusable and recyclable items.
4. Let each child pick an item and create a new use for the item or create a new item.
5. Make posters about pollution as a separate activity.

What Now?

1. Let each child share his/her information.
2. Begin advertising for the junk sale day.
3. Set up for the sale. Be sure to price each item or sell everything for one price for convenience.
4. Invite the grades in your area to the sale.
5. With the earned money, buy a tree or a birdhouse - or both!
6. Encourage the children to look for ways they can reduce and reuse at home.

Barter Day

Grade Level : 1

Subjects:
Social Studies 8.5, 9.3
Communication Skills
2.1, 2.2

Time:
one class period for introduction and card game, one afternoon for Bartering Day

Setting:
classroom, library, gym, or cafeteria for Bartering Day

Materials:
cards for game - prepare cards using the attached sheet. Back the cards with tagboard and laminate

Skills:
classifying

Vocabulary:
trash or treasure
finite
natural resource
barter

Source:
Let's Put Waste in Place Learning Kit, Kathy Klein.

Summary: The children will host a "Barter Day" for the purpose of trading toys and other items with each other. To learn about bartering, they will play a card game similar to *Go Fish*.

Objective: The children will learn that through bartering, fewer things will end up in the landfill. Natural resources will be preserved, and money will be saved.

Background: In our "throwaway" society the first thing most of us think of when something is broken or no longer suits us, is get rid of it, toss it, throw it away. As a result, our natural resources are dwindling and landfills are becoming more expensive. Bartering has always been a viable option to money for "buying" things. Many cultures still use forms of bartering to get what they need and/or want.

Leading Question: How can we get something for almost nothing? What are some ways to protect our finite resources?

Procedure:

1. Open discussion with leading question. "How can we get something for nothing or almost nothing?"
2. Introduce the term "bartering." Explain how the early settlers didn't have much money but still needed basic things in order to live. They traded with their neighbors and other settlers to get the things they needed or wanted. These might include services as well as goods.
3. Divide the class into groups of five or six children each. Give each group a deck of bartering cards. One child acts as the dealer, dealing each child five cards. The remainder of the deck is placed in the center of the circle and becomes the "Go Trade" stack. The children take turns asking any other child in the group for a particular item. If the child has the item, he/she must give it up. If not, the child bartering must draw from the "Go Trade" deck. The first person to match all his/her items is the winner.
4. Discuss the kinds of things we might "barter" today. List some ways bartering could help the environment.

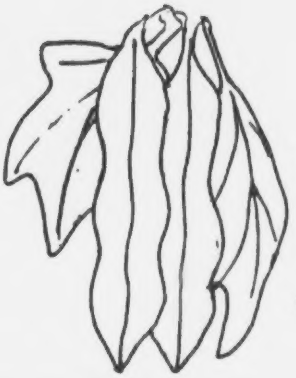
What Now?

1. Plan a Bartering Day with your class or with other classes at your school.
2. Brainstorm items that could be bartered.
3. Get parental permission for children to barter objects they bring in.
4. Classify items into the natural resource group from which they are made.
5. Hold the Bartering Day.
6. Take leftover items to a local thrift store or Santa's Toy Box.
7. Have students suggest items for barter. Fill in the blank spaces on bartering cards with student suggestions.

BARTERING CARDS

Divide the class into groups of four or five children. Each group has a deck of bartering cards. One child acts as the dealer and deals out five cards to each child. The remaining cards are stacked in the middle of the group and used as trading cards. The children take turns asking any other child in the group for a particular item. If the child has the item, he/she must give it up. If not, the bartering person must draw from the trade stack. The person with the most matches is the winner.

Note: Make two sets of cards for each deck.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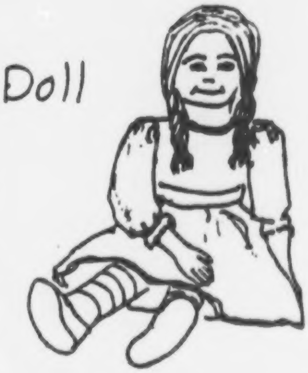
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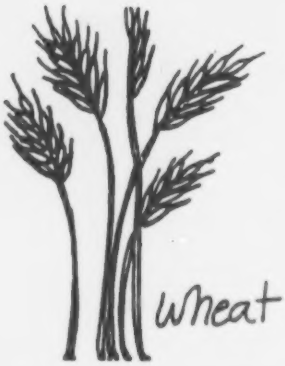
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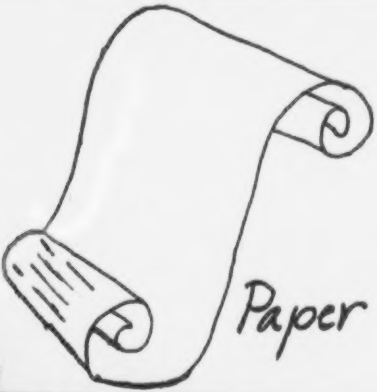
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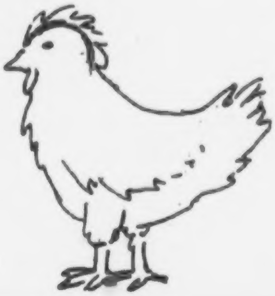

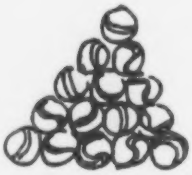
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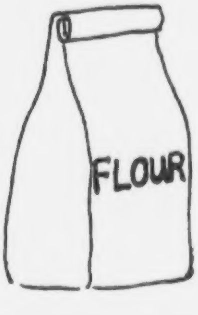
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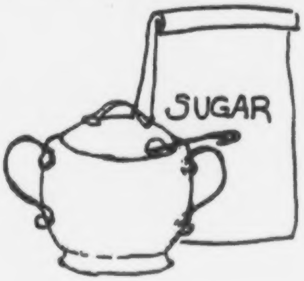
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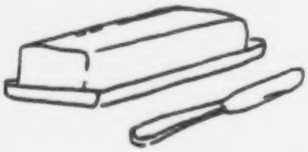
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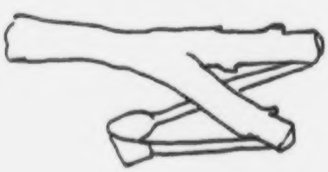
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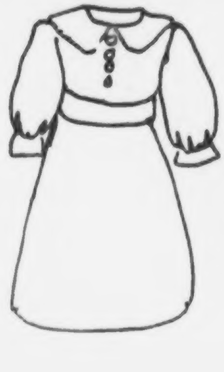
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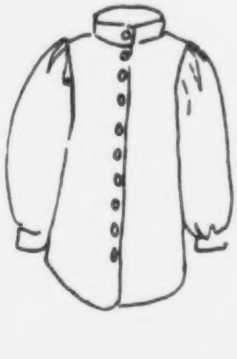
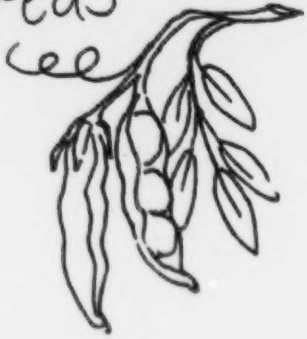

Shirt

1.15

Peas



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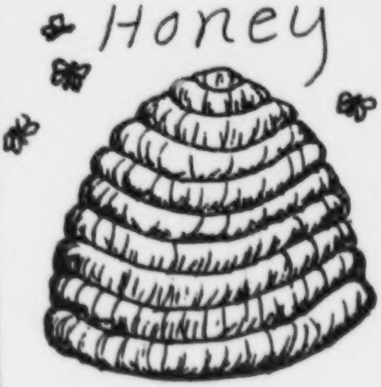
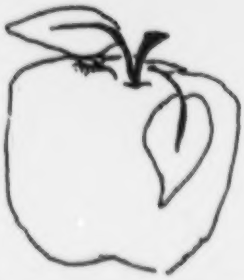
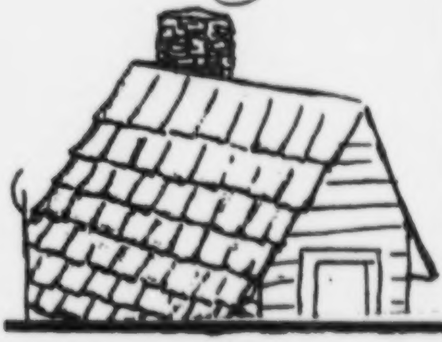
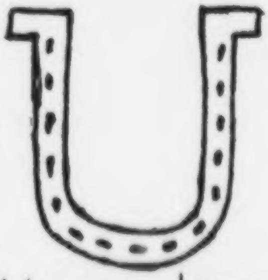


Apples

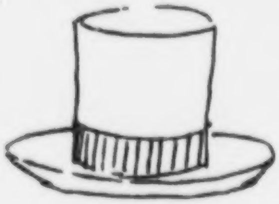


Shingles



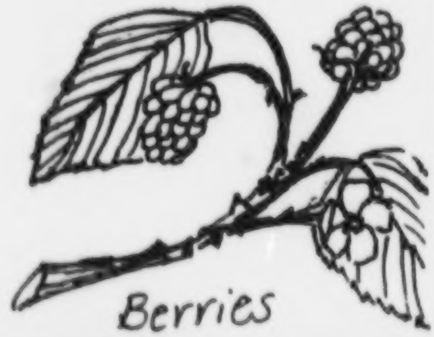


Horseshoes

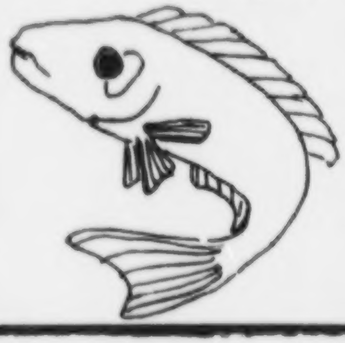


Hat

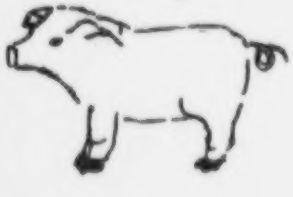
Fish

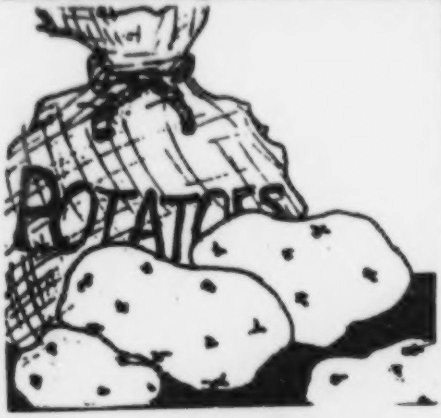


Berries

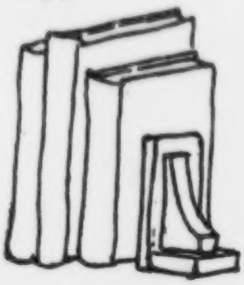


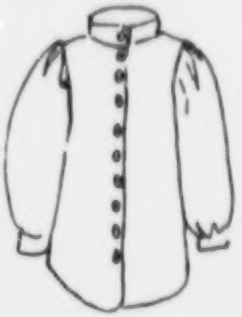
Pig





Books





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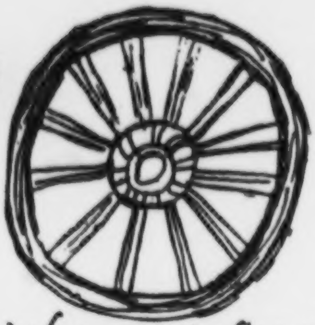
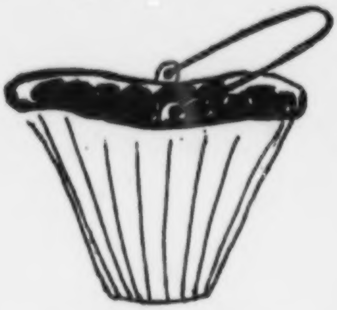
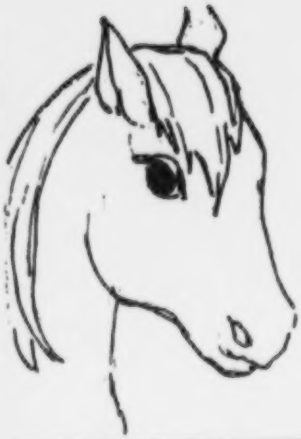


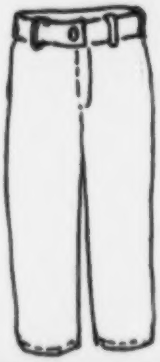
Wagon Wheel

Coal

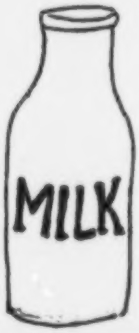




Horse



Pants



NATURAL RESOURCES

Old Toys

Grade Level : 1

Subjects:
Communication Skills 2.3
Social Studies 8.5
Science 2.2, 4.2

Time:
one class period
outside class interviewing
one class follow-up

Setting:
classroom

Materials:
pictures or examples of antique toys, children's favorite toys

Skills:
comparing, communicating, describing, observing, classifying

Vocabulary:
plastic
natural materials

Source:
AVR Teacher's Resource Guide
Association of Vermont Recyclers.

Summary: Children will compare toys from the past with their toys now noticing the kinds of materials used to make the older toys as compared to the materials used to make the newer toys.

Objective: The children will learn that toys made from natural materials tend to last longer than those made from today's human-made or synthetic materials. Since natural materials such as wood and plant fibers are biodegradable, they are not as harmful to the environment.

Background: Through the years, toys have changed in the way that they are manufactured and in the materials. The plastic toys of today have a greater impact on our environment than the older toys made from natural materials because plastic toys are not as durable.

Leading Question: What is your favorite toy?

Procedure:

1. Have children bring in toys that are broken and might be thrown out. Ask: What is this toy made of? How long did it last? How could you make this toy last longer? Can these broken toys be fixed or made into new toys?
2. Discuss the way older toys were made and the materials they were made from. How are the older toys different from toys today?
3. How do toys from other cultures compare with our toys today?
4. Develop some interview questions the children can use to interview an older member of their family or community.
   For example:
   1. What was your favorite toy when you were little?
   2. How many toys did you have?
   3. What were they made of?
   4. Who made them?
   5. What happened to the toy if it broke?
   6. How are toys today different from those you had?
   7. Do you still have any old toys?
   8. Can I bring one to school?
5. Have children draw some toys that would be "environmentally friendly" and write how or why each toy would help the environment.

What Now?

1. Visit a nursing home so the children can spend some time interviewing the elderly about toys.
2. Invite grandparents to come in for interview sessions.
3. Make simple cornhusk dolls.
4. Get on the Internet and interview students from around the world.
5. Check out the book Good As New by Barbara Douglass (available at most county libraries).

PACKAGING

Bag Lunch

Grade Level : 1

Subjects:
Science 2.2, 4.2
Social Studies 4.2, 8.5

Time:
one class period

Setting:
classroom

Materials:
a bag lunch for each child prepared by the cafeteria staff, a packaging journal for each child

Skills:
classifying

Vocabulary:
packaging
excessive

Sources:
Action for a Cleaner Environment
South Carolina Dept. of Health and Environmental Control

Watauga County Recycling Curriculum Committee

Summary: The children will classify the remains of a bag lunch to determine what leftovers can be recycled and what packaging can be reduced.

Objective: The children will learn that a lunch can be packed without using excess packaging, or with only reusable packaging to create a "trash-free" lunch.

Background: Excess packaging - packaging beyond safety and fresh standards - contributes unnecessarily to the solid waste stream.

Leading Question: What packaging is necessary?

Procedure:

1. The children will eat a lunch, in the classroom if possible, which has been prepared by the cafeteria staff.
2. After eating their lunch, have children separate the leftovers into packaging materials and food scraps.
3. Examine the packaging materials. Decide which ones are necessary for freshness and/or safety. Sort these materials according to necessary/not necessary packaging.
4. Discuss the unnecessary packaging and brainstorm some alternatives to this packaging.
5. Separate the food scraps, putting the appropriate ones into the wormbox for vermicomposting or put the scraps in a compost bin.
6. Discuss ways to encourage students to reduce leftover food by taking smaller portions.
7. Have each child make a list or draw a picture of things in his/her lunch that were packaged excessively.
8. Have each child make a new list or draw a picture of a better way to package these items.
9. Discuss ways to pack a lunch so it is "waste free."

What Now?

1. Go to the grocery store with your parents. Take a close look at the way things are packaged. Record your findings in a special journal for packaging.
2. Share your findings with the class.
3. Make a family decision to shop more responsibly.
4. Consider starting an "offer vs. serve" program at your school. (See appendix for more information.)

WASTE DISPOSAL

The Turtle's Mishap: A Puppet Show

Grade Level : 1

Subjects:
The Arts 1.1
Science 2.2, 2.7, 2.6
Social Studies 3.3, 8.5

Time:
2 sessions - 30 minutes

Setting:
classroom

Materials:
stick puppets for play characters, examples of marine debris such as: sandwich bags, milk jugs, dental floss, foam cups, plastic six-pack rings, aluminum cans

Skills:
inferring, predicting

Vocabulary:
marine debris
trash
entangled

Source:
Earth Child - Kathryn Sheehan and Mary Waidner; Council Oak Books; Tulsa, OK.

Summary: Marine debris has become such a problem that each fall, organized beach, lake, and river sweeps are held to clean up the litter in and around these bodies of water. The objective of these activities is to make life a little safer for the animals that live in these habitats and humans who use them for livelihood and recreation.

Objective: The children will learn the importance of keeping our waters free from litter because of the potential harm to marine and human life.

Background: Trash which hits the water is known as marine debris. Many marine animals die each year as a result of humans' garbage. Beach/river sweeps have become annual events in North Carolina.

Leading Question: What happens to the plastic litter we throw into the rivers and oceans?

Procedure:

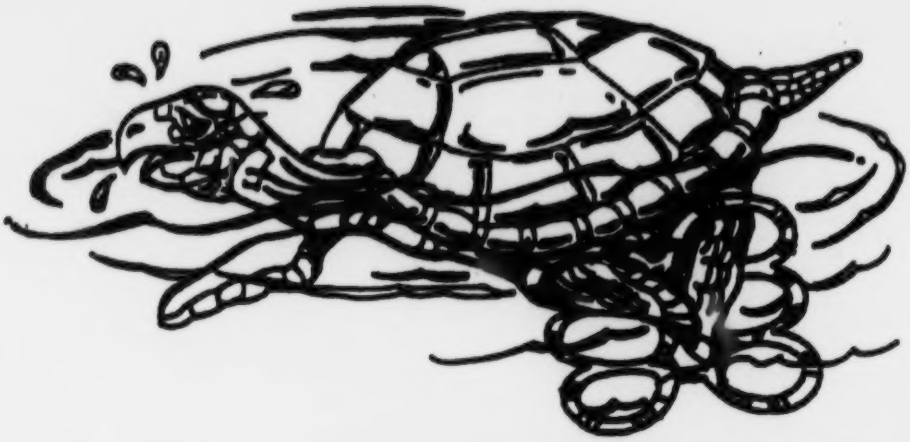
1. Have the students design stick puppets of a turtle, fish, sea bird, octopus, seal, and lobster from something that could be reused (brown bags, Styrofoam trays, paper plates, etc.).
2. Create an underwater scene for the stage.
3. Read the story "The Turtle's Mishap" or "A Penguin In Trouble."

What Now?

1. Show video - "The Death of a Whale." (Environmental Media, P.O. Box 1016, Chapel Hill, NC 27514. FAX: 919-942-8785. Price: $9.95 plus S&H for NC teachers)
2. Participate in North Carolina's Big Sweep. For information, call (919) 828-6686.
3. Take a garbage/trash bag to the beach or lake or river and clean up.
4. "Help! I Can't Get It Off!" activity.

Ask: What is it like to become entangled in debris and unable to free yourself? Take a rubber band and loop it around your thumb, stretch it over the back of your hand (not the palm), then loop it around your little finger. Pretend that you are a sea creature that has become entangled in some marine debris. Without using your other hand, any other part of your body, or object, try to free yourself from the rubber band. You can move your hand in any fashion and use the fingers on the entangled hand.

The Turtle's Mishap: A Puppet Show



Cast of Characters: Sea Turtle, Fish, Cormorant (sea bird with dark feathers and webbed feet), Octopus, Seal, and Lobster.

As the curtain opens, a sea turtle is swimming around in circles. On one side of his body, make it obvious that his flippers are entangled in a plastic six-pack ring. They are so tangled, they cannot move. His other flippers, though, are free and are paddling back and forth. Because of this, he is only able to swim in a circle.

Turtle: Help! Please, help. My flippers are stuck. *(He continues to struggle and swim in circles. Then along swims a fish and he stops to watch the turtle.)*

Fish: What a strange thing to do. Why are you swimming in circles?

Turtle: Oh, please Mr. Fish, can you help me? My flippers are stuck and I can't get them free.
(Have the fish try to help the turtle by pulling on the plastic ring with his mouth.)
Fish: Oh, you really are stuck! Tell me, how did this happen?

Turtle: I was swimming along and I just didn't see this plastic ring floating in the water. Before I knew what had happened, it was looped around my flipper. I tried to get it off, but then I got my back one stuck too.

Fish: I remember when something like this happened to me. I was poking my head in the rocks on the bottom looking for food, and all of a sudden it was stuck in an old, rusty tin can. It took me quite a while before I was finally able to shake it off. *(Looking behind him and rushing off, he says:)* Woops, I've got to run or I'll be somebody's dinner. Good luck!

(A cormorant, a dark sea bird that swims underwater to catch fish, swims by and is perplexed by the circling turtle.)

Cormorant: You'll never get anywhere going around in circles like that.

Turtle: Maybe you can help. My flippers are stuck in this plastic ring. With your pointed beak, I'll bet you could get a good grip on it.

Cormorant: I'd be happy to try.
(So the cormorant tugs and pulls on the ring, but is unable to free it.)

Cormorant: I'm sorry, I can't budge it! You know, this reminds me of something that happened just last week. I was paddling on the surface when all of a sudden my legs were tangled in some fishing line. As I was trying to get free, it must have caught on something and I was pulled underwater. I could have drowned, but I was lucky enough to get out of that tangled mess just in time. Speaking of that, I need to go catch a breath. I'm sorry I couldn't help.
(The cormorant swims off, leaving the turtle alone. He continues to struggle and swim in a circle. After a time, along swims an octopus.)

Octopus: Is this a new dance or something?

Turtle: No, it's not a dance. I'm going around in circles because my flippers are stuck in this plastic ring. Say, you have a lot of strong legs, could you help me by pulling it off?

Octopus: Let me see what I can do.
(So the octopus tries many different ways to pull the ring off, but his efforts are unsuccessful.)

Octopus: This trash is really a problem. There have been many times I thought I was picking up a clam, only to discover it was the top of a jar or a hunk of glass.
(Along swims a seal.)

Seal: What's going on here? Are you two fighting?

Octopus: No, not at all. I'm trying to pull this plastic ring off Turtle's flippers. Would you care to help?

Seal: I'd be happy to.
(So the two of them tug at the ring, but it doesn't come free.)

Turtle: Ouch! It is so tight, my flippers are really beginning to hurt. Is there something else we can try?

Seal: Once I got caught in an old fishing net. I chewed and chewed until I cut it enough to break free. But this ring is much thicker, I don't think I could chew through it.

Octopus: That gives me an idea, I might know someone who could help.
(The octopus swims off to search for his friend and returns with a lobster.)

Octopus: See, here's the turtle I was telling you about. Do you think you could use your claws and cut through that plastic ring?

Lobster: I'm not sure, but let me try.
(The lobster cuts the plastic ring with his claws and the turtle is free.)

Turtle: Oh, thank you so much. I was beginning to think I would have to swim around in circles for the rest of my life.
(The cormorant and fish return.)

Fish: I just came back to see if you were all right.

Cormorant: I see you got free of the plastic ring. You were lucky this time!

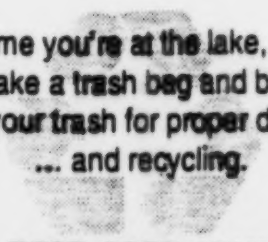
Turtle: I know ... thanks to Lobster. I'll try to be more careful. But sometimes it's impossible to see the trash, especially those plastic rings or bags. Sometimes I wonder if humans think our ocean is just a big garbage can!

Seal: Everybody, listen. What's that noise?
(A faint rumbling sound can be heard and then it gets louder. All of the creatures watch as a motor boat passes overhead. As it goes by, a bunch of trash is thrown overboard and rains down on the animals.)

Turtle (gravely): I just wish they'd stop and think!
(All of the creatures nod in agreement and then the curtain closes)

From: Earth Child - Kathryn Sheehan and Mary Waidner, Council Oak Books, Tulsa.

Just Do It



Next time you're at the lake, river or beach, take a trash bag and bring back all of your trash for proper disposal ... and recycling.

1.22

A Penguin in Trouble
Adapted by Lynn Coulthard

Cast of Characters: Penguin, Whale, Scua, Petrel, Seal, and scientist

A penguin is flipping around on the ice. His feet are entangled in a plastic six-pack ring.

Penguin: Help! Please, help. My feet are stuck. *(He continues to struggle and roll around on the ice. Then along swims a whale, and he stops to watch.)*

Whale: What a strange thing to do. Why are you rolling around on the ice?

Penguin: Oh, please Mr. Whale, can you help me? My feet are stuck and I can't get them free. *(The whale tries to help the penguin by pulling on the plastic ring with his teeth.)*

Whale: Oh, you really are stuck! How did this happen?

Penguin: I was swimming along and I just didn't see this plastic ring floating in the water. Before I knew what had happened, it was looped around one of my feet, then when I tried to get it loose, I got the other one stuck.

Whale: That happened to me once, too. Of course I didn't get my feet stuck, I got my head caught in an old fishing net. By breaching and leaping, I finally got it off. *(Looking behind him and swimming off, he says:)* Woops, I've got to go, I see my dinner over there. Good Luck!

(A Scua flies low overhead and seeing the penguin on the ice comes in for a landing.)

Scua: What are you doing? I thought penguins were swimmers not rollers.

Penguin: I am a swimmer but my feet are stuck in this plastic ring and I can't do anything but roll. Can you help with your beak?

Scua: I'll try. *(So the scua pulls and tugs with his beak but isn't able to free the penguin.)*

Scua: I'm sorry. I can't get it to budge. This reminds me of a time when I was fishing and thought I saw a fish swimming close to the surface of the water. Easy dinner for me, I thought. Well, it wasn't a fish at all, it was a plastic baggie. It got looped over my beak. Talk about a frightening thing. I almost suffocated before I got it off. Got to go, now. Bye, and I hope you're free soon. *(The Scua flies off.)*

Petrel: Penguin, are you dancing or what?

Penguin: I wish it was a new dance. Can't you see I'm trapped in this plastic ring? Maybe you could help.

Petrel: Let me see what I can do. *(The Petrel tries, but he isn't able to help.)*

Petrel: This trash is really a problem. I can't believe the humans are actually coming all this way to destroy our land and sea. *(Along comes a seal.)*

Seal: What's going on here. Stop that fighting!

Petrel: We're not fighting. Penguin is trapped, and I'm trying to help him. Would you like to help, too?

Seal: I'll do my best. *(Seal chews on the ring, but isn't able to chew through it.)*

Penguin: Ouch! You're hurting me! It's getting tighter.

Seal: I know just how you feel, Penguin. I got one of these things hung on my nose once. A friend of mine was able to chew through it, but this one is much thicker.

Petrel: That gives me an idea. I might be able to get you some help if I can just find him.

Others Together: Find who? *(But the Petrel flies off without answering.)*

The Petrel soon returns with a visiting scientist.

Petrel: This is my friend. He's been feeding me scraps from his lunch. I think he can help you.

Scientist: This is awful! When will humans learn? I can cut that thing off for you. *(The scientist gently cuts the ring and frees the penguin.)*

Penguin: Oh, thank you so much. I was beginning to think I would have to roll around the rest of my life.

The Whale and Scua return.

Whale: So you're free at last.

Scua: Who helped you? This human? I'm glad some humans care.

Penguin : I was lucky this time. I'm going to have to be more careful when I take a dive, that's for sure. As long as humans think this sea is nothing but a big garbage can, no one is safe.

Seal: Everybody listen. What's that noise? *(A faint rumbling sound can be heard* *and then it gets louder. All of the creatures watch as a helicopter flies over head. As it goes over, a bunch of trash is tossed out of the cockpit and rains down on the ice.)*

Penguin: I just wish they'd stop and think!

Scientist: Me, too.

Adapted from The Turtle's Mishap

WASTE DISPOSAL

NoWhere Is Away

Grade Level : 1

Subjects:
Communication Skills 4.3
Science 2.1, 2.4, 2.7
Social Studies 4.2
The Arts 4.10

Time:
one forty minute class period or two twenty minute sessions

Setting:
classroom

Materials:
words to the song "My Garbage Floats Over the Ocean," poems: "Dirty Water Blues" and "Everywhere is Somewhere"
litter material: fruit peelings, glass, paper, etc.

Skills:
conserving, observing, preserving, communicating, predicting

Vocabulary:
litter
garbage
ocean

Source:
Action For a Cleaner Tomorrow
South Carolina Department of Health and Environmental Control

Summary: Children will create a lake full of litter, learn a song and some poems, and discuss what happens to our garbage.

Objective: Students will understand that through poetry and song there is no place that will make garbage disappear.

Background: Many people think that because the ocean is so vast, dumping garbage into it will not hurt anything or anyone. As a result of this all-too-common practice, our oceans are becoming dangerously polluted, affecting not only the marine life, but humans who depend on that marine life for their livelihood or recreation.

Leading Question: What happens to the things we throw away?

Procedure:

1. Review the vocabulary with the children using magazine pictures of garbage and litter.

2. Recite the poems "Dirty Water Blues" and "Everywhere is Somewhere." Ask the children what they have seen in our rivers and creeks. Make a chart of the things they mention. Review the sequence of trash when it is flushed down the drain using the poem "Everywhere is Somewhere."

3. Sing "My Garbage Floats Over the Ocean" to the tune of "My Bonnie Lies Over the Ocean."

4. Create some litter in a glass-jar lake. Observe the "lake" for two weeks. Discuss the condition of the lake - What happened to the water? What happened to the litter? Would you want to swim in water like that? What might happen to the plants and animals that live there? Is the ocean big enough to absorb all this garbage?
5. Discuss the issue of garbage barges looking for a place to go. Discuss the problem of medical neddles washing up on shore.

What Now?
1. Participate in North Carolina's Big Sweep of its waterways. For information phone (919) 828-6686.
2. Collect money or raise money toward the purchase of litter receptacles to be placed at popular fishing and recreation spots.
3. Investigate the possibility of starting a stencil program to label storm drains. For example, "This drain empties into_____Lake or River.

My Garbage Floats Over The Ocean

(Tune: My Bonnie Lies Over The Ocean)

My Garbage Floats over the ocean.

My garbage floats over the sea.

My garbage floats over the ocean.

My garbage comes back to me.

Come back, come back, come back my garbage to me...

Action for a Cleaner Tomorrow, South Carolina Department of Health and Environmental Control

"NoWhere Is Away"

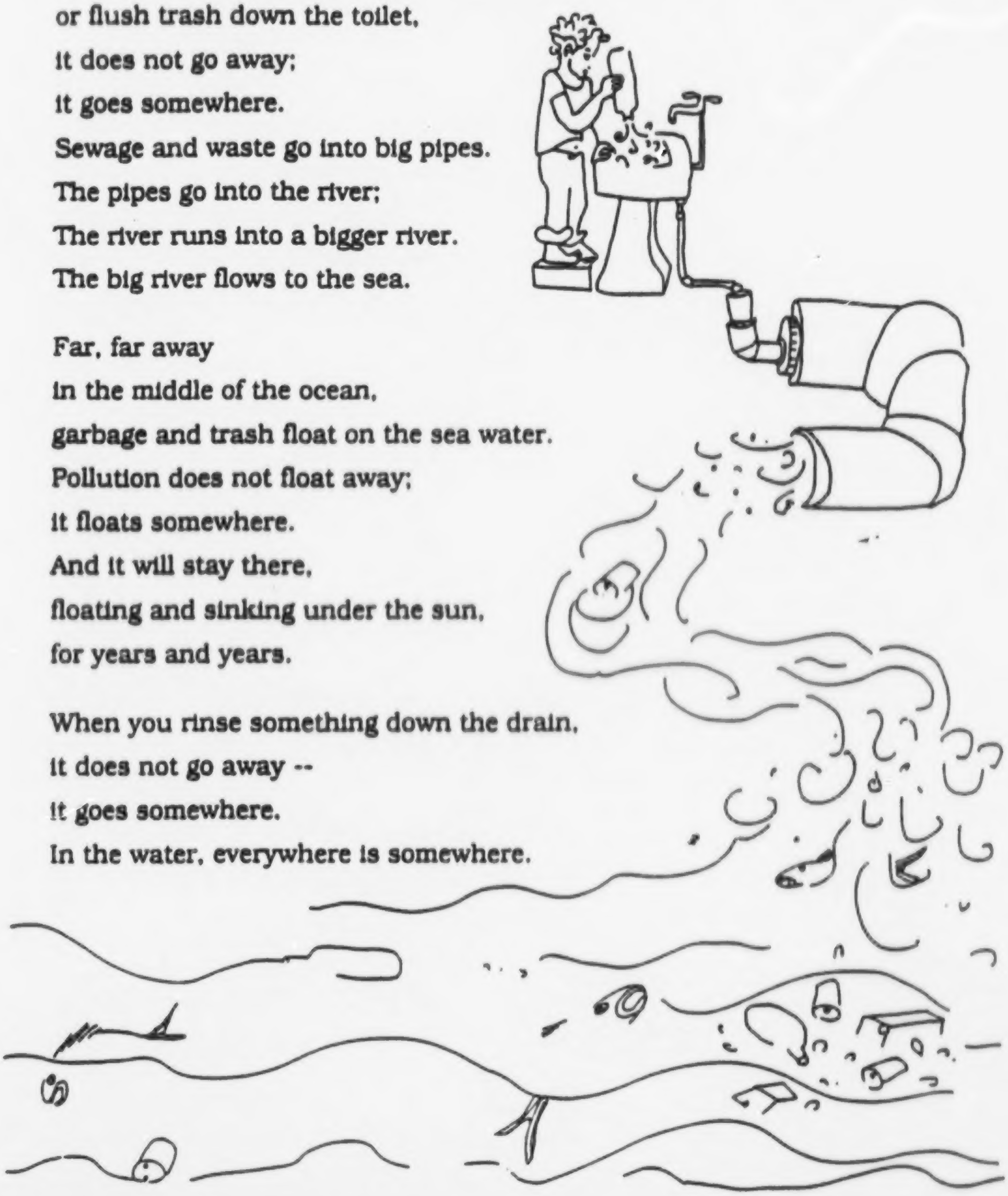
Name: **Date:**

Everywhere Is Somewhere

When you rinse garbage down the drain of a sink,
or flush trash down the toilet,
it does not go away;
it goes somewhere.
Sewage and waste go into big pipes.
The pipes go into the river;
The river runs into a bigger river.
The big river flows to the sea.

Far, far away
in the middle of the ocean,
garbage and trash float on the sea water.
Pollution does not float away;
it floats somewhere.
And it will stay there,
floating and sinking under the sun,
for years and years.

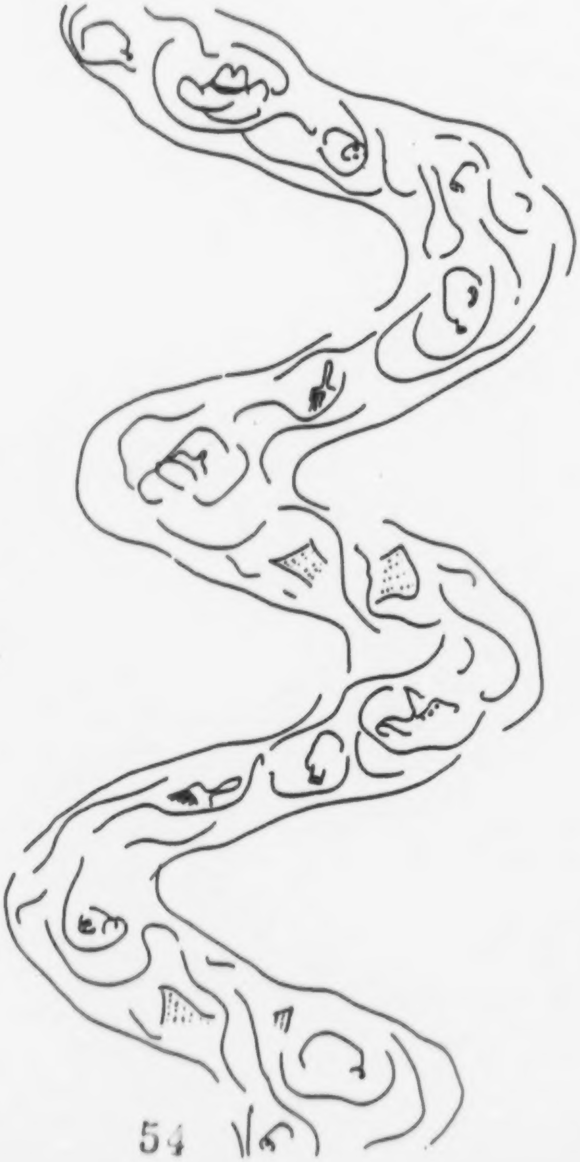
When you rinse something down the drain,
it does not go away --
it goes somewhere.
In the water, everywhere is somewhere.



Name: **Date:**

The Dirty Water Blues

Pure water gurgles
and splashes along
until pollution
flows into the song:
oil
tar,
paint,
dye,
mud and muck
come splashing by.
Cans,
jars,
bottles,
cars.
Old shoes, old news--
that's the dirty water blues.
Sweet, fresh water
rolls away from this song,
while dirt and pollution
keep flowing along
and along,
and along...



WASTE DISPOSAL

It's Hot In Here!

Grade Level : 1

Subjects:
Science 2.2
Social Studies 8.5

Time:
thirty to forty minutes

Setting:
classroom

Materials:
clean garbage that can be recycled or reused, colored paper strips labeled a specific type of garbage, string, signs labeled *Reduce*, *Reuse*, and *Recycle*

Skills:
observing, predicting, inferring, classifying

Vocabulary:
biodegradable

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will represent different kinds of garbage, making a human landfill.

Objective: Through this activity, students will become aware of the many things we needlessly throw away.

Background: The average North Carolina citizen disposes of 5.6 pounds of garbage per day. Landfills are necessary and expensive to build. Some counties may use their landfills as a "host" site and, as a result, the landfill becomes a source of revenue for the county. Landfills are not designed to promote decomposition. For your own information, investigate the issues surrounding the landfill in your county.

Leading Question: What else can this garbage be?

Procedure:

1. Give each child a colored paper strip indicating a particular item of trash. Actual items such as plastic containers, small glass jars, etc. can be used.
2. As the students get their strip, they take their place in the landfill. Mark off with string a designated area in the room for the landfill.
3. When the landfill is full, let the children discuss how they are feeling (hot, cramped, etc.).
4. Ask if they think they can biodegrade. What do they need to biodegrade? (Air, water, microbes, and food equal to nitrogen and carbon.)
5. Let each child suggest an alternative to being tossed in the landfill.
6. As each suggestion is given, the child can move to a new site - Reduce, Reuse, or Recycle. Discuss the items left in the landfill. Can they biodegrade now? If not, why? The items that can be reduced can go to a special spot and disappear.

What Now?

1. Start a mini-recycling center in the classroom or a swap-shop to reuse items.
2. Encourage children to start a recycling program in their own homes.
3. Sing - "Garbage" by Tom Chapin on Chapin's cassette, "*Mother Earth.*" (Available at most record shops.)

N♻C

SECOND GRADE

TITLE	MAJOR TOPIC	PAGE NO.	SUBJECT AREAS COVERED
Crayon Trash Stash	3 R's	2.1	💡 🎨
A Rotten Idea	3 R's	2.2	💡 🧩
Trash To Treasure	3 R's	2.6	⚖ 🧩 💡
Litter Garden	3 R's	2.10	💡 👥 ⚖
Go Fish	NATURAL RESOURCES	2.12	💡 🧩
Machine	NATURAL RESOURCES	2.15	💡 👥
Angry Animals	PACKAGING	2.17	💡 👥
Where Oh Where?	WASTE DISPOSAL	2.19	💡 🧩
Litter Walk	WASTE DISPOSAL	2.24	💡 ⚖

Crayon Trash Stash

Grade Level : 2

Subjects:
Science 2.1, 2.6, 4.2, 4.3
The Arts 3.4

Time:
thirty to forty-five minutes

Setting:
classroom

Materials:
new and used crayons
art paper

Skills:
sorting
inferring

Vocabulary:
trash
recycle
reuse
landfill

Source:
Action for a Cleaner Tomorrow
South Carolina Department of Health and Environmental Control

Summary: Students will sort crayons into new or broken/used piles. Students must then make a picture using only the good crayons.

Objective: Students will look at ways resources are wasted. They will consider alternative ideas to throwing out used, broken, and worn out items.

Background: Reusing things is important to reducing the amount of trash we throw away. Crayons are a fun way to demonstrate how easy it is to reuse things you might otherwise throw away.

Leading Question: What happens to something that is sent to a landfill?

Procedure:

1. Give each student a handful of crayons. (Some should be new, used, worn, and broken)
2. Ask students to sort crayons into two piles; new and broken/used.
3. Have students describe their imperfect crayons. List responses. Tell them the imperfect pile of crayons is "trash" and they are to stash their trash in the landfill (in their desks or in a bag).
4. With the perfect crayon, color a "perfect" rainbow and sky picture. Do not share crayons.
5. Display pictures. Have students respond either orally or written to some of these questions: What happened when we had limited resources? Do you wish you had more colors? Why do we throw things away? List reponses.
6. Explain that usually when something goes to a landfill it stays forever but this time they may reclaim the crayons. Have students add to their pictures. Think how crayons can be reused or recycled.

What Now?

Make Sun Catchers
Materials: used crayons, a hand grater, wax paper, an iron, a pad of newspapers, and a brown sack cut open.

1. Have students remove any paper from the crayon.
2. Ask an adult volunteer to grate the crayons into separate colors.
3. Students sprinkle shavings on top of a sheet of wax paper. (Keep colors separate)
4. Cover with second sheet.
5. Use pad of newspaper to protect surface from the iron.
6. Put open brown paper bag on top of newspaper as a blotter.
7. Use scraps of construction paper to make a frame or mat for the suncatchers.
8. Used crayons can be mixed with paraffin to make candles.

A Rotten Idea

Grade Level : 2

Subjects:
Science 2.1, 2.7, 2.9, 4.2
Social Studies 4.5

Time:
one class period initially - observe over a period of time.

Setting:
classroom

Materials:
large glass jar, food scraps (not meat or cheese), leaves, grass clippings, soil, etc.

Skills:
observing, predicting, collecting information, analysis

Vocabulary:
waste
decompose
compost
vermicompost

Source:
Watauga County Recycling Curriculum Committee

Summary: To help students learn what composting is and how it can help reduce wastes.

Objective: Students will learn that some wastes are recyclable by composting.

Background: Many items that go into our solid waste stream could be more effectively used. Students will observe changes in the materials they place in the jar.

Leading Question: What do you think happens to the food you throw away?

Procedure:

1. Have some students collect an assortment of food scraps from the cafeteria (no meat or cheese).
2. Have some students collect leaves, grass clippings, twigs, etc. from the school yard.
3. Place 2 inches of soil in the bottom of a large jar. Moisten slightly. Place scraps on top of the soil.
4. Leave the jar open and place on the window sill. Observe daily and record changes. A lid with holes may be used to increase humidity and reduce odor. You may layer with yard waste or shredded paper to reduce odors as well.
5. Predict how long it will take to turn the materials into soil.

What Now?

1. Each day record how materials look and smell in the jar.

2. Talk about decomposition and what it means.

3. Have students write why they think this was an effective way to dispose of this waste.

4. Create a working compost pile or wormbox in the classroom. Use "Compost Critters" sheet or "Build a Worm Box! It's Easy and Fun!"

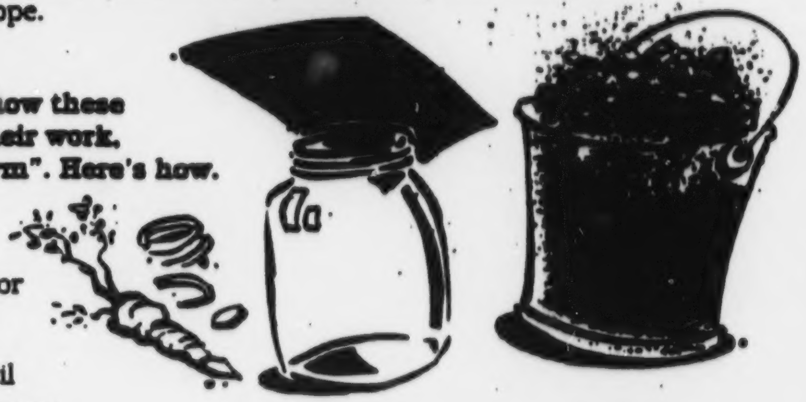
5. Use results from composting or use vermicomposting to plant seeds.

2.3

Compost Critters

You can turn yard and kitchen scraps into super soil by throwing them into a compost bin instead of into the garbage. Grass clippings, coffee grinds, apple cores, and cabbage leaves can all be transformed. How does this magic work?

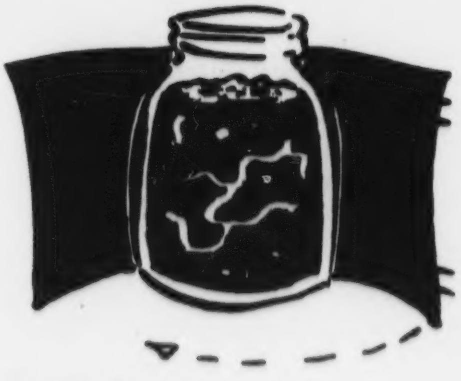
Creatures in the compost chew up and digest the plant material you give them. Some of these creatures, like red worms, sow bugs, and centipedes, are big enough to see without a magnifying glass. Others, especially the bacteria, are so small that you can only view them with a powerful microscope.



To get an idea of how these living things do their work, set up a "worm farm". Here's how.

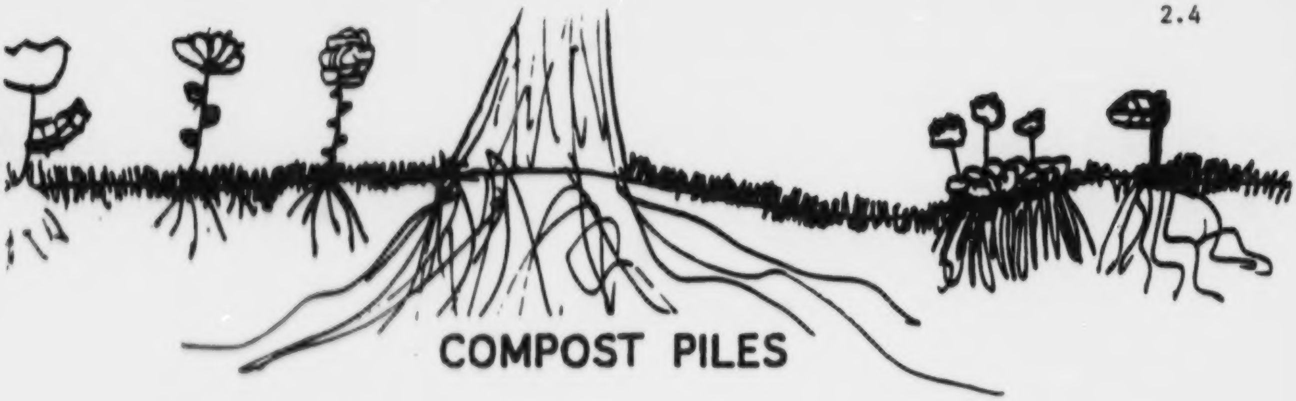
You'll need:

- a large glass jar or small aquarium
- a bucketful of soil containing red worms
- black paper
- lettuce leaves and carrot peelings



1. Place the soil in the large container.
2. Add enough water to make it slightly moist.
3. Wrap the black paper around the container to keep it dark below the soil surface.
4. Place bits of lettuce and carrot peelings on top of the soil.

Watch your "worm farm" for several days, being sure to add water if it begins to dry out. Remove the black paper when you want to observe what's happening under the surface. Have your earthworms made tunnels? Can you see why they're such an important part of any garden?



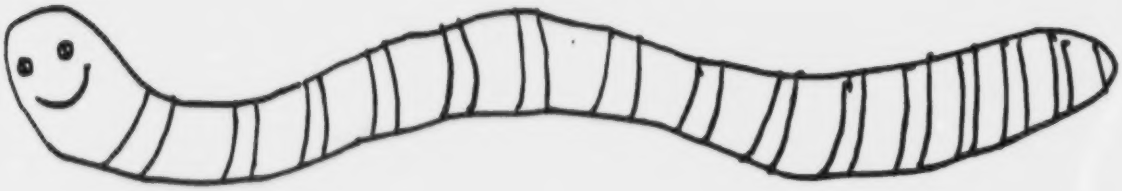
COMPOST PILES

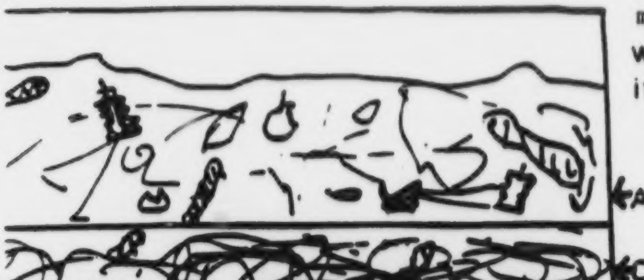
*reduce trash

*add to soil richness (so plants can grow better!)

*provide food for red worms

*keep red worms warm and snuggly!





microbes live in compost piles that work to heat the pile and help break it down or DECOMPOSE.

Air, water, food scraps, and soil

Composting cycle begins

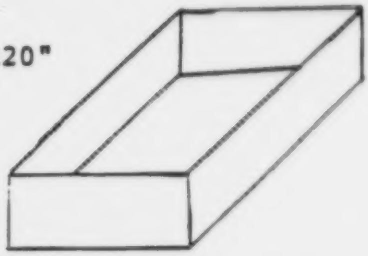
Composting cycle continues

Composting cycle ends with rich soil ready for gardens!!

BUILD A WORM BOX! IT'S EASY & FUN!

HEY THERE! Not quite ready to start a compost pile but know you should do something with all those vegetable peelings and leftovers? Well...worms would like those tidbits! As a home project, build a worm box. A few pounds of worms will eat all the vegetable waste produced by two people in a six-month period. As an added benefit, you get some of the best gardening soil (called castings) possible.

The box:



Don't use treated wood. Plywood is fine. Drill at least 8 holes in the bottom of the box so the worms can get some air.

The box should be kept in an area where it doesn't get any colder than 45-50 degrees.

The contents:

5 pounds of shredded paper
approx 2 gallons of warm water
2 pounds (5000) worms
a handful of dirt

The recipe :

Put the shredded paper in a large, waterproof container. Pour in 1 gallon of water and stir well. Add the second gallon of water slowly and keep stirring. The paper should be damp. When the paper is well-mixed, put it in your worm box. Add the worms and dirt and spread them over the surface. The worms will work their way down into the paper to avoid the light. Begin to feed them your fruit and vegetable peelings, crackers, and just about anything else. **NO ANIMAL FAT, SKIN, OR BONES. Keep the paper damp.**

Keep a piece of dark plastic or cardboard over the top of the box--worms don't like the light. If you find the worms are not eating everything you give them, cut back on the amounts or get more worms.

In six months, you should be able to split the batch, add more paper, and keep going. Use some of the castings (that's the dirt in the worm box) for potting houseplants or simply add it to your garden.

For more information, check your local library for a book entitled, Worms Eat My Garbage, and have fun.

Trash To Treasure

Grade Level : 2

Subjects:
Math 3.1, 3.2
Social Studies 4.4
Science 4.2

Time:
two class periods

Setting:
classroom

Materials:
books, toys, clothes, or other items to swap, slips of paper numbered (2 sets), hat

Skills:
observing, classifying

Vocabulary:
trade
swap
barter
reduce
repair
reuse

Source:
Watauga County
Recycling Curriculum
Committee

Summary: Students learn how some disposable items they use can be replaced by more durable items that can be reused again.

Objective: Students will identify items they no longer use or want. Discussion will explain how reusing things reduces the amount thrown away. Students will see how reusing things saves resources and money.

Background: Use the phrase "One man's trash is another man's treasure." This old philosophy is back in style. Reusing is one of the best ways to reduce the amount of garbage we throw away. One way to reuse items is to have a yard sale or a swap meet. At a yard sale, things sell for very reasonable prices. At a swap meet, people don't pay for items, they trade them for other things.

Leading Question: What do you do with books and toys you no longer want? What happens to the clothes you can not wear?

Procedure:

1. Organize a class Swap Meet. Each student brings in one item to swap for another. (It is best to limit this to a certain type of item such as books or small toys.)
2. Explain that trading allows items to be used several times before it becomes waste. Trading is a way to make less waste.
3. Set rules for the swap and send parent letter. All items should be clean and usable.
4. At the Swap Meet each student shows their item.
5. Place all items on table and attach a number. Place a corresponding number in a hat.
6. Each student draws a number and takes the corresponding number from the table.
7. Suggest other items that can be reused.

What Now?

1. Invite a guest speaker from local thrift store to talk about items used for reuse.
2. Have students draw a picture of the item when it was new.
3. Have students write a story about the item they received at the Swap Shop or at a yard sale.
4. Have students do "Reusable Materials and Objects."

Trash To Treasure (Continued)

This is a sample letter that may be used to notify parents of your classroom Swap Shop:

Dear Parents,

Our class has been studying the environment. Next week we will explore how reusing things can save resources and reduce the amount of garbage that goes in North Carolina's landfills.

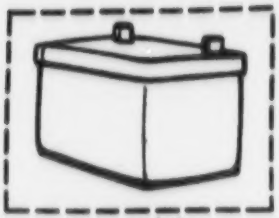
We are planning a Swap Shop to find new uses or users for items your child may no longer need or use. I am asking each student to bring a small, clean, inexpensive book, toy, or trinket that they no longer want. These will be swapped among the students and will not be returned. Do not purchase new items for the swap.

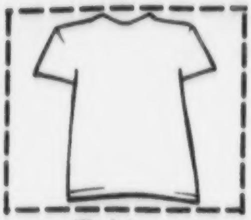
Our Swap Shop will be held______________________. Thanks for your support on this project. I hope this will be a fun and important lesson on taking care of our environment.

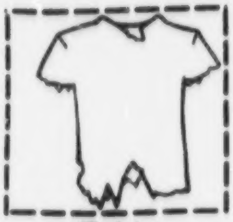
Sincerely,

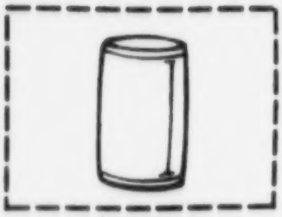
REUSABLE MATERIALS AND OBJECTS

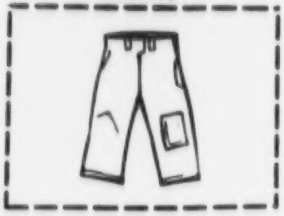
Directions: Cut out each illustration below along the dotted lines. Look at each illustration carefully and put it in the correct column on the handout, ***Classifying Reusable Objects***.

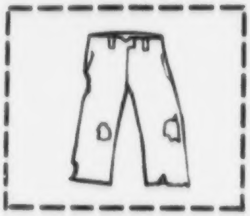

automobile battery


T-shirt


T-shirt


aluminum can


jeans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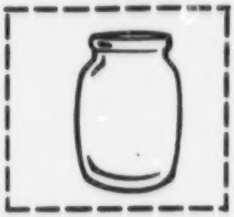
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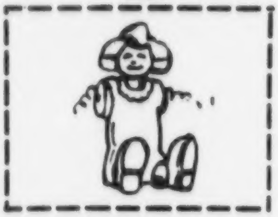
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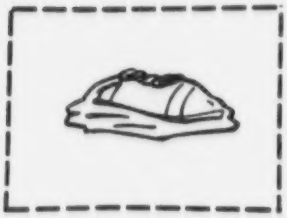
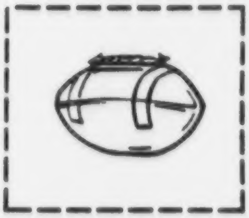
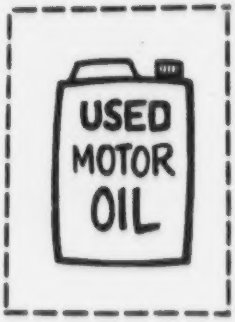
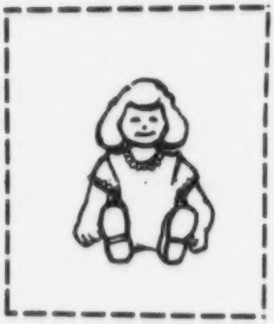

football


football

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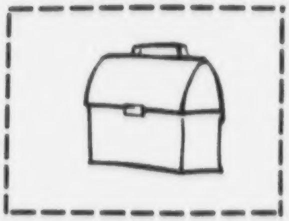
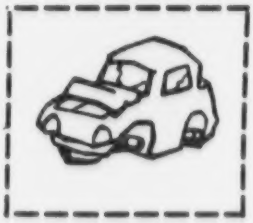
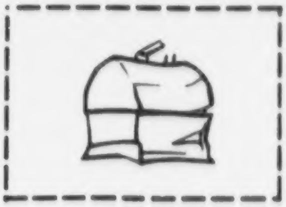

lunch box


toy car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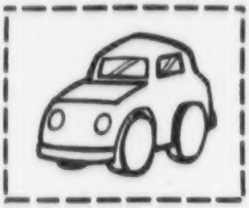
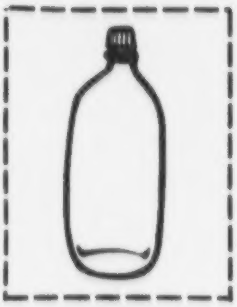
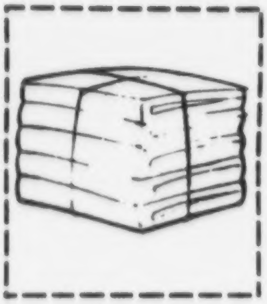

toy car


plastic bottle


newspapers

Directions: Classify the objects on the handout, *Reusable Materials and Objects*, by putting them into the categories below:

REUSABLE	RECYCLABLE

NATURAL RESOURCES

Litter Garden

Grade Level : 2

Subjects:
Science 2.1, 2.2, 2.7, 2.9
Communication Skills 4.1
Math 3.2, 6.2, 6.3, 6.4

Time:
two month time span, forty-five minutes at the beginning and end

Setting:
classroom

Materials:
two 6"-8" deep waterproof trays, samples of several different solid wastes, soil (not potting soil) and spray bottle

Skills:
sorting, predicting, observing, recording, and interpreting data

Vocabulary:
decomposition
litter
natural
human-made
environment
biodegradable

Sources:
AVR Teacher's Resource Guide
Association of Vermont Recyclers.

Pennsylvania Recycling and Waste Reduction
Pennsylvania Department of Education and Office of Environmental Education

Summary: Students will collect and place objects in soil. Water will be added and results recorded over a two month period.

Objective: Students will observe and compare decomposition rates for objects in a composting environment. They will discuss the effects of littering on the environment.

Background: Some of the packaging we use today, though convenient and useful for a short time, cause environmental problems because it depletes our natural resources and is not biodegradable. Some substances even poison the environment.

Leading Question: What happens to our trash after we put it in a composting facility?

Procedure:

1. Collect samples of litter. Review the difference between natural and human-made materials. Develop a definition of decomposition.
2. Use worksheet with students to predict which kinds of materials will decompose and which will not.
3. Put two to four inches of soil in trays. Arrange samples so there is space between each one. Make a marker to identify each one. Cover samples with two to four more inches of soil. Add enough water to moisten. Add a little water daily.
4. After a two month period, uncover and check progress.
5. Discuss results.
6. What do our results tell us about handling wastes? Were our predictions correct?
7. How are landfills different from composting facilities?

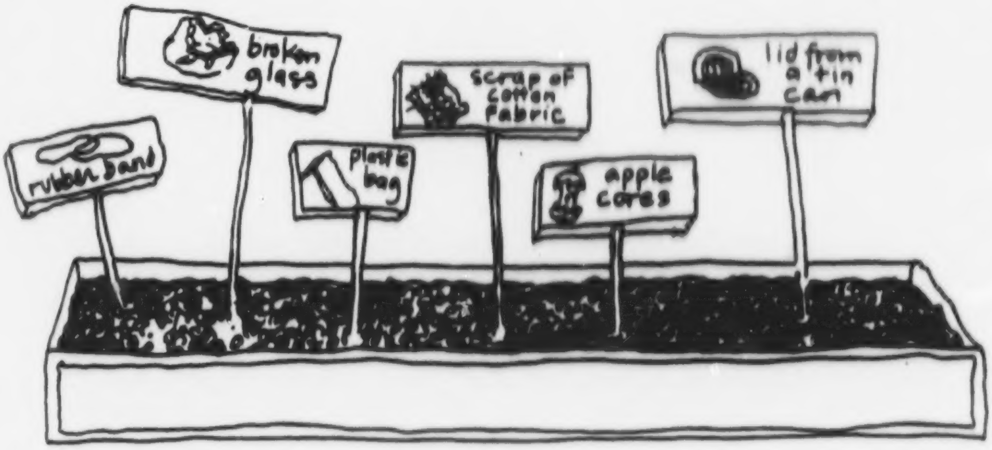
What Now?

1. Chart decomposition rates of different human-made litter on a timeline or bar graph.
2. Record possible solutions to help reduce the amount of waste we use.
3. Draw pictures of different litter objects. Sequence which will decompose first, second, third.
4. Write stories or epitaphs for each object buried. Tell where it came from, its purpose, and how it became trash.
5. Make a large kite with a sad face on it. Tell the students that the kite is sad because from up in the air it sees many things that make it unhappy. They are to write a story explaining what would make it happy again.

2.11

"LITTER GARDEN WORKSHEET"

Name: **Date:**


rubber band
broken glass
plastic bag
scrap of cotton fabric
apple cores
lid from a tin can

1. **Which objects do you think will decompose first?**

2. **Which will take the longest to decompose?**

3. **Which might never decompose?**

4. **Which will be the best for the soil?**

5. **Which might harm the soil?**

NATURAL RESOURCES

Go Fish

Grade Level : 2

Subjects:
Science 2.1, 4.2
Social Studies 4.5, 6.3

Time:
two class periods

Setting:
classroom

Materials:
fishing pole made from a dowel rod, string, and a magnet,
collect 3 empty tin cans,
2 wooden blocks,
steel bottle caps,
steel nails,
a steel can opener,
blue poster board.
(avoid bimetal cans made of tinned steel and aluminum), tape or velcro strips, 2 signs, worksheet for each student

Skills:
sorting, classifying, and observing

Vocabulary:
aluminum
magnet
magnetic steel
tin

Source:
Watauga County Recycling Curriculum Committee

Summary: Students "fish" for items with a magnet. Students will distinguish between aluminum, steel, and tin.

Objective: Students should be able to sort aluminum cans from steel cans for recycling by using a magnet. Students will use observation skills to identify recyclable items.

Background: Product packaging is a significant part of our solid waste stream. Much of this packaging ends up in our landfills. Recycling saves space, natural resources, and energy. Every aluminum can we throw away is like wasting half a can of gasoline. Recycled aluminum cans can be back on the shelf within six weeks. (see "Recycle Cycle" in the Appendix)

Leading Question: Did you know all aluminum and steel cans are recyclable? Today we will identify products that have aluminum in them and can be recycled.

Procedure:

1. Look up the meaning of magnetism. Explain aluminum is not attracted to a magnet.
2. Label two boxes with the words "Save and Recycle Steel" and "Save and Recycle Aluminum."
3. Place collected objects on blue poster board.
4. Pass out the "What Will A Magnet Attract?" sheet.
5. Using the magnet fishing pole, students will test each object and record answers on their sheet.

What Now?

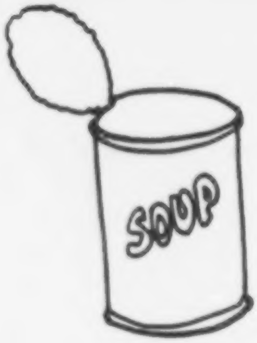
1. Discuss results of handouts. Develop reasons for recycling objects.
2. Start a collection of cans from the cafeteria and/or classrooms.
3. Assign different students to collect aluminum and steel cans.
4. This collection can be weighed and measured.
5. Students record findings.
6. Students place aluminum and steel cans in collection area or take to a recycling center.
7. Paste a copy of "Recycle Cycle" above your collection containers. (See Appendix)

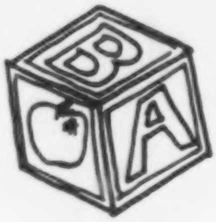
2.13

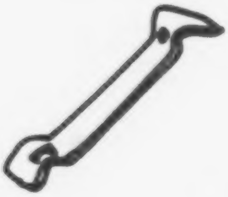
WHAT WILL A MAGNET ATTRACT?
for "Go Fish" activity

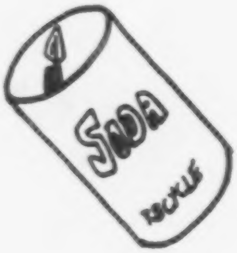
Directions: Circle the objects that a magnet will attract.

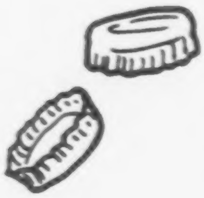
Illustrated by: Carl Johnson

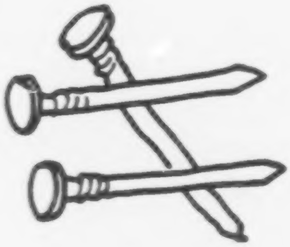












NATURAL RESOURCES

Machine

Grade Level : 2

Subjects:
Science 2.2, 2.3, 2.4, 2.6, 4.2
Communication Skills 4.1

Time:
one or more class periods

Setting:
classroom

Materials:
objects or pictures from magazines for bulletin boards, sheet, four chairs

Skills:
observing, sorting, classifying, and communicating

Vocabulary:
natural resource
renewable
non-renewable
machines
mineral
oil
source

Sources:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Action for a Cleaner Tomorrow
South Carolina Department of Health and Environmental Control

Summary: The earth is the source of everything we make, use, and throw away. Students will pretend they are machines making objects.

Objective: Students will become aware of the natural origins of many products and will realize the limited availability of some natural resources.

Background: Use the "Natural Resource Bulletin Board" idea showing the four natural resources. Have students collect pictures and/or real objects to match each resource. (With younger children, use only one resource category at a time.) Use a sheet draped over chairs to make a machine. Have students go through the machine and become a new product. Discuss the change with the class.

Leading Question: Where do the things we use come from? Can we help save our natural resources?

Procedure:

1. Put up bulletin board showing each of the four natural resource categories of mineral/oil, mineral/rock, plants, and animals.
2. Cut pictures and collect from each category.
3. Drape a sheet over four chairs, two on each side, to make a machine. Choose two students to play the roles of electricity and gas. When a student enters the machine, these two make machine-like noises.
4. Assign the role of one of the four resources to each student. As they come to the back of the machine, hidden from the class, the teacher hands the student a finished product made from the resource. Student enters the machine (noises should be made) and comes out holding the finished product, which is then deposited at the proper part of the bulletin board.
5. After each student has gone through the machine, discuss renewable and non-renewable resources. Where does the oil and gas come from? Can we grow more oil? If we buried the plastic doll, would it go back to oil? Can we grow more trees? animals? minerals? What can we do to avoid using up all our resources? What is the source of everything we use?

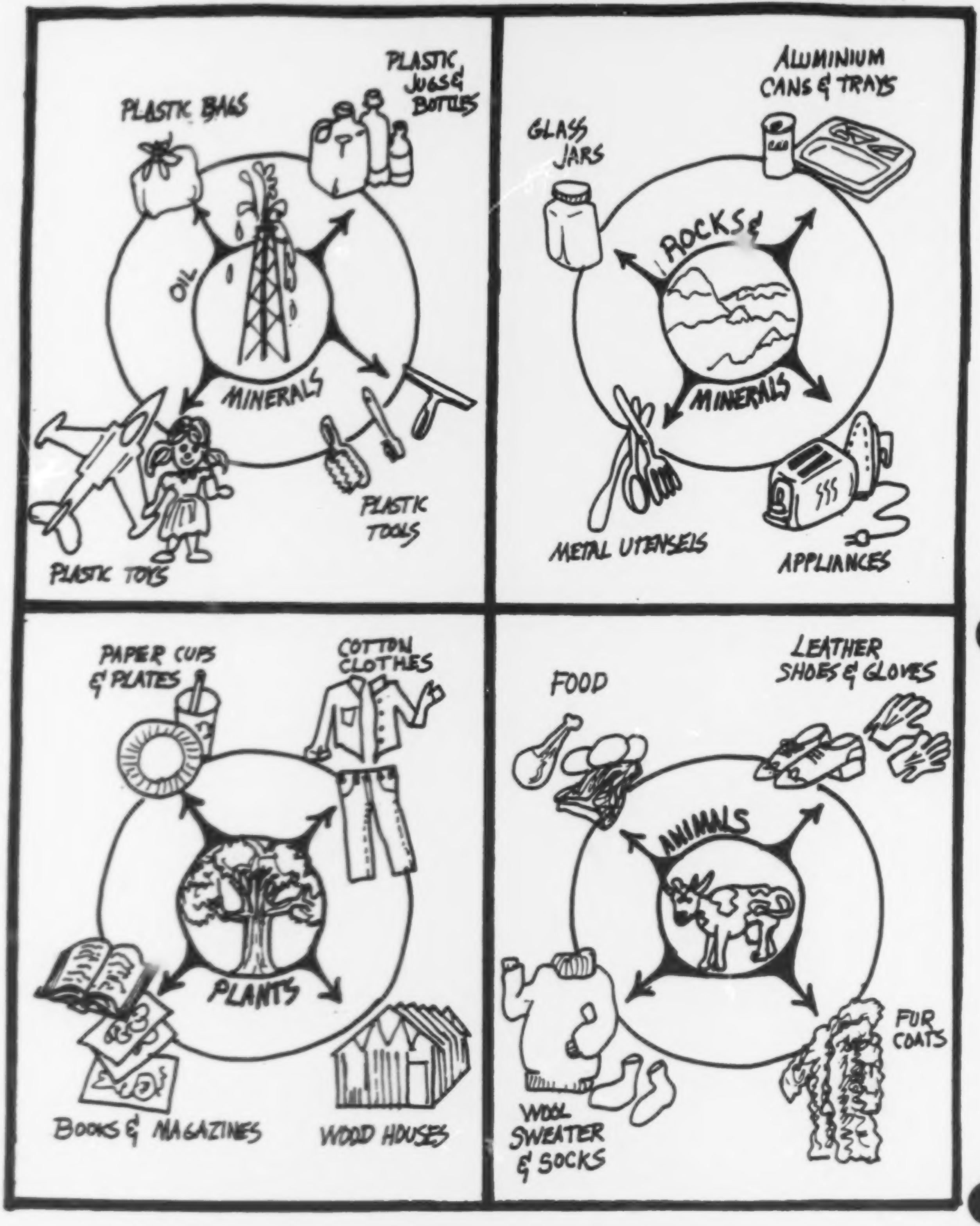
What Now?

Demonstrate to students that natural resources can be recycled by taking finished products through the machine and recycling them into different new products. Plastic soda bottles can become a ski jacket; a newspaper can become a cereal box or stationery.

2.15

Natural Resource Bulletin Board

Illustrated by: Carl Johnson


PLASTIC BAGS
PLASTIC JUGS & BOTTLES
OIL
MINERALS
PLASTIC TOYS
PLASTIC TOOLS
GLASS JARS
ALUMINIUM CANS & TRAYS
ROCKS & MINERALS
METAL UTENSELS
APPLIANCES
PAPER CUPS & PLATES
COTTON CLOTHES
PLANTS
BOOKS & MAGAZINES
WOOD HOUSES
FOOD
LEATHER SHOES & GLOVES
ANIMALS
WOOL SWEATER & SOCKS
FUR COATS

PACKAGING

Angry Animals

Grade Level : 2

Subjects:
Science 5.2, 5.3
Communication Skills 3.3, 4.1

Time:
two class periods

Setting:
classroom

Materials:
assortment of trash such as plastic wrap, six-pack carriers, bottle caps, pieces of plastic, wire, nails, etc. One 12" x 18" sheet of drawing paper per student, crayons, masking tape, glue.

Skills:
describing, evaluating, classifying, interpreting

Vocabulary:
harmful
litter
wildlife
habitat

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will construct pictures showing how litter can be harmful to animals. The students will evaluate how certain products can be harmful.

Objective: Students will describe how some litter is harmful to animals.

Background: Thousands of animals die each year because of the waste humans leave behind. Students will discuss how animals meet their food and safety needs (they digest food and they move). Class will explain how littered, unnatural objects might cause problems for animals when they eat or move.

Leading Question: What do animals need to stay healthy?

Procedure:

1. Students should bring in a piece of litter they think may be harmful to animals. (The teacher may do this or may add to the collection to insure a variety.)
2. Discuss safety when handling these objects and how they can be harmful to animals.
3. Have each student pick a piece of litter and tape or glue it on their 12" x 18" sheet.
4. The student should draw a picture depicting what harm could come to the animal if it came in contact with this piece of litter.
5. Have students imitate how their animal moves before and after injury.
6. Hold a group discussion about what could be done to avoid the problems litter can cause for wildlife.
7. Have students write questions from the animal's point of view to go along with their picture. (Example: "Why didn't that person throw the bottle in the recycling bin? Then I wouldn't have cut my paw.")
8. An alternative would be to write stories about their picture.

What Now?

1. Have each student choose one litter item they think is most harmful to animals. Tell why.
2. Have students rank order waste items according to the possible harm they could cause wildlife.
3. Discuss ways the situations depicted in their drawings could be avoided.
4. Ask students what happens to a helium balloon after it is released in the air.

Angry Animals (continued)

What Now? (continued)

5. Invite someone from a park, a local veterinarian, or from the Humane Society to relate stories about animals found dead, injured, or in danger because of what people have done to the animal's habitat.

6. Collect some feathers. (Chicken or duck feathers work best.) Have students observe them with a hand lens. Pour water in tin pans. Have students dip feather in and out of water and observe. Next use a small amount of oil and rub on the feather. Have students observe and note changes. Now have student to rub water on feather to wash off oil. Try using soap. Note what has happened. Ask students to record observations.

7. Read the book *The Mitten* by Jan Brett.

WASTE DISPOSAL

Where Oh Where?

Grade Level : 2

Subjects:
Science 2.1, 2.2, 2.3, 2.4, 2.9, 5.2
Social Studies 8.5

Time:
three class periods

Setting:
classroom

Materials:
pictures for characters in role play. Survey for home and a bag of clean trash.

Skills:
analyzing, sequencing

Vocabulary:
landfill
garbage truck
waste stream
leachate

Sources:
Action for a Cleaner Tomorrow
South Carolina Department of Health and Environmental Control

AVR Teacher's Resource Guide
Association of Vermont Recyclers

Summary: Students will be able to define home waste and do a garbage survey.

Objective: Students will: define waste and consider the implications, analyze their family's waste stream, decide how waste can be reduced if we reuse or recycle, dramatize the trip to the landfill.

Background: Most of our garbage ends up in a landfill. Landfills must meet strict state and federal regulations. Landfills must protect the surrounding land and water against harmful effects of leachate that might seep from the landfill. New landfills must by law be lined with strong plastic to keep that from happening but that isn't always enough. For instance, leachate from Watauga County's unlined landfill contaminated nearby land and water. By reusing, reducing, and recycling, we can reduce the amount of waste that goes into our landfills. Where does your county or city's trash go?

Leading Question: What happens when we throw things away?

Procedure: Begin by examining contents of a trash bag. Discuss difference between trash in different places. What kind of trash would come from the classroom, cafeteria, or their home? Decide which objects can be recycled or reused.

Discuss where our trash goes after it leaves our houses. Make props for the class and dramatize the garbage truck going from the house to the landfill, dumped, and then covering it up. Consider some reasons why this may not be the most efficient way of disposing of our waste. What can we do differently? Students can take home a survey to evaluate their home waste stream.

What Now?

Discuss the following questions with students:

1. Why do we need landfills?
2. Why can't we just throw our garbage on the road or in our back yard?
3. What happens when the landfill gets full?
4. What kinds of things did your family throw away?
5. Were you surprised by the amount of trash that was thrown away? Explain.
6. How did your trash compare to other student's trash?
7. Were items thrown away that could have been reused or recycled?

Where Oh Where? (Continued)

What Now?

1. Use "Here's What I Found Snooping Through the Garbage" survey sheet and parent letter for students and parents to evaluate their home waste stream.

2. Have the class produce a large chart indicating what they found while going through their garbage.

3. All living creatures produce waste of some sort. Humans are very wasteful compared to other creatures. Often we are unconcerned or unaware of what happens to our waste and the implications of it. Compare the ways different plants and animals dispose of waste.

4. Have students do the "Garbage Detective" activity.

Students can pick their favorite animal. Have them draw the animal's home and their home. List waste each one might have. Do animals have garbage? Who produces more garbage, people or animals? What are some differences and similarities between waste generated by people and animals?

Where Oh Where? (Continued)

Dear Parents:

Our class is participating in a project about recycling and waste reduction. We will learn how we can recycle and reuse materials so we can reduce the amount of garbage we throw away. For this project you and your child will examine the garbage you produce.

Your child has been given the following instructions for this activity:

1. Ask family members to put all their trash in a predetermined collection area. For health reasons, do not include yard wastes or food items in the materials collected.
2. At the end of each day, empty the contents on a large plastic sheet. In the yard or in a garage is best.
3. Wear gloves and separate the garbage into categories: plastic, paper, glass, metals, (tinned items, steel cans, aluminum, other). Then count (or weigh) each category. Record findings on chart. Keep recyclable items separate.
4. Return all trash and recyclable items to appropriate areas.
5. After a week your child will write a summary of their findings and return it to class.

We are encouraging our students to understand that they can make a difference. We all need to be aware of waste and its implications. We hope you will encourage your child by making this a family project. You are helping to build a better, more responsible community. Thanks for reducing, reusing, and recycling.

Sincerely,

2.21

Here's What I Found Snooping Through The Garbage.

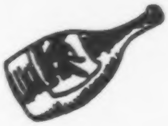
Days of the week	Aluminum	Scrap Paper	Newspaper	Glass	Tin Cans	Plastic	Is it Recyclable or Reusable ?

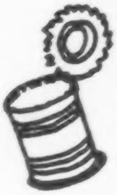
GARBAGE DETECTIVE

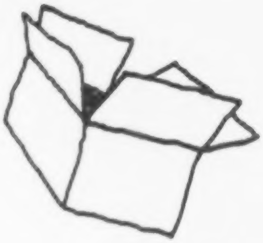
Name:

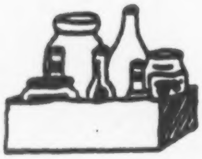
Date:

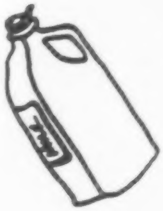
Save these from the trash.
Draw a line from the trash object to its bag of recyclables.

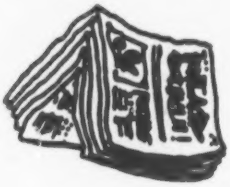


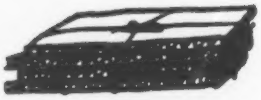


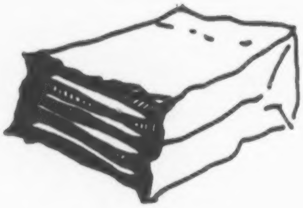


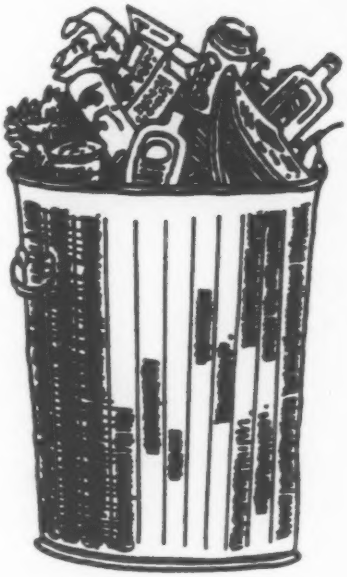


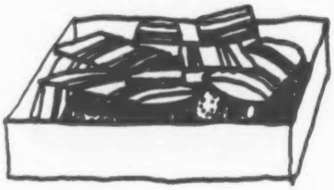


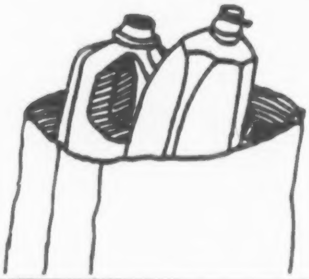












WASTE DISPOSAL

Litter Walk

Grade Level : 2

Subjects:
Science 2.1, 2.2, 2.7, 2.9
Math 3.1, 3.2, 6.2

Time:
one class period

Setting:
classroom and/or outside

Materials:
recycled bags, local litter, used cardboard for displays or posters

Skills:
observing, classifying prediction, classifying, displaying

Vocabulary:
natural
human-made
litter
sort
dispose
compost
natural resource

Source:
Watauga County Recycling Curriculum Committee

Summary: Leftovers disposed of improperly become litter. Litter can be human-made or natural. Human-made litter needs to be sorted and disposed of in ways to save some of the natural resources that produced the products.

Objective: Students will identify human-made objects and natural objects. They will classify as litter or not litter.

Background: Solid waste can be classified as natural or human-made. Any waste disposed of improperly is considered litter. Natural litter such as leaves, seed pods, branches can enrich natural systems if left to decompose or if composted. Human-made litter needs to be sorted and disposed of in special ways. This can help save some of our natural resources. Natural means all things made by nature that people or machines cannot make. These include all living things, plants, and animals. It also includes non-living things such as rocks, dirt, and sand. Human-made objects mean anything in our world that people or machines make. To help reinforce vocabulary, see "It's Our Bag" activity (page 2.25).

Leading Question: What is the difference between human-made and natural litter?

Procedure:

1. Write “natural” and “human-made” on a board or poster. Have students brainstorm objects around the room that are natural or human-made. Each student should touch the object and name its primary use.
2. Use recycled bags for litter bags. Students can be teamed for a “litter walk” around the school grounds. Students should record their findings and check if it is human-made or natural litter.
3. In class discuss findings. Each group may sort and display both kinds of waste.

What Now?

1. What is litter?
2. What kinds of litter are there?
3. How should we dispose of the litter we collected? (list examples)
4. Do "Litter Garden" activity on page 2.10.
5. Do the composting activity contained in the lesson "A Rotten Idea" on page 2.2.
6. Fold a piece of paper into fourths. Have each student draw 2 natural and 2 human-made examples of litter.

Litter Walk (Continued)

What Now? (continued)

7. Feeling Box - Make a "feely box" by cutting a fist size hole in the side of the box. Cut the end off a sock and attach it to the hole. Place several small natural and human-made items in the box. See if students can determine difference by using sense of touch.
8. Sort and Classify
   -Have each student bring in one natural (moss, leaves, branch, seed, shell, fruit, bird's nest, fur, sand, worm, plant, egg, etc.) and one human-made object (key, toy, clothing, pencil, cup, glass bottle, button, crayon, etc.)
   -Place objects on a table where students can view them.
   -Identify each object. Ask student to group objects according to attributes such as color, size, hardness, softness, length, etc.
   -Explore meaning for "natural" and "human-made."
   -Have students arrange the objects into either natural or human-made.
   -Divide class into small groups. Do a litter walk collecting natural and human-made samples of litter. Have each group create a "litter critter".
   -Have students create a story about their "litter critter."
   -Do a matching exercise.

"It's Our Bag"

Name: ____

Match each word on the left with the phrase that best describes it.

Trash

Litter

Reuse

Natural Resources

Landfill

Recycling

Paper

Reduce

Compost

A. To find a new use for something instead of throwing it away.

B. A recyclable material made from trees.

C. To buy less and to throw away less trash.

D. Leaves and grass clippings, vegtable wastes that are broken down by natural forces and can be used on gardens.

E. Our garbage, all the things we throw away.

F. Trash that is in the wrong place, such as on the ground or in the street.

G. A manufacturing process that makes something new out of something old.

H. The place where trash is buried.

I. Things that are found in nature that we must have to live.

ANSWER KEY
for
"IT'S OUR BAG"

A. REUSE

B. PAPER

C. REDUCE

D. COMPOST

E. TRASH

F. LITTER

G. RECYCLING

H. LANDFILL

I. NATURAL RESOURCES

THIRD GRADE

TITLE	***MAJOR TOPIC***	***PAGE NO.***	***SUBJECT AREAS COVERED***
A Paperless Trail	*3 R's*	*3.1*	💡 🧩 👥
Everything Old Is New Again	*3 R's*	*3.2*	💡 🧩
What Goes Around...	*3 R's*	*3.4*	💡 🧩 ⚖ 👥
Getting On The Bandwagon	*3 R's*	*3.10*	🧩 👥
Waste In Time	*NATURAL RESOURCES*	*3.12*	✎ 👥 🧩 💡
From Beginning to End and Then...?	*NATURAL RESOURCES*	*3.14*	🧩 👥 ⚖ 💡
What's It Made Of?	*NATURAL RESOURCES*	*3.17*	💡 🧩 👥
Packaging: Waste or Wonderful?	*PACKAGING*	*3.19*	🧩 ⚖ 👥
"Litter"ally a Mess	*WASTE DISPOSAL*	*3.21*	💡 🧩 👥
Pile It On	*WASTE DISPOSAL*	*3.25*	💡 🧩 ⚖ 👥
"Our Throwaway Spree"	*WASTE DISPOSAL*	*3.27*	💡 🧩 👥 ✎

A Paperless Trail

Grade Level : 3

Subjects:
Science 1.4
Social Studies 2.3, 5.3, 8.2, 9.4
Communication Skills 2.2, 4.2

Time:
one homework assignment before the lesson, one class period for lesson, one class period to present to others

Setting:
classroom

Materials:
supplies for team projects/lessons

Skills:
analyze, classify, observe, persuade, evaluate, present, write, create

Vocabulary:
persuade
substitute
source reduction

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will analyze how they use paper products and discover ways to eliminate certain paper use from their daily routine. Then they will prepare creative ways of encouraging others to use paper wisely.

Objective: Students will become aware of ways to reduce the amount of paper they use and will encourage others to reduce paper use.

Background: It takes large amounts of energy and many trees to make the paper we use so thoughtlessly every day.

Leading Question: What can we substitute for the paper products we use and throw away?

Procedure:

1. A couple of days before the lesson, give this homework assignment. Ask students to write down every single paper product they use for 24 hours. (During school hours be sure to point out any time paper is being used. This will reinforce the habit before going home.)
2. For the lesson, divide the chalkboard into 3 large columns: Necessary, Not Necessary, and Substitute. Using their lists, students take turns adding paper products they used in the last 24 hours to one of the first two columns. When a good number of examples are given, the class then brainstorms possible substitutes for certain paper products. These are listed in the third column. (Examples: handkerchief, instead of tissue; cloth hand towel rather than paper towel; cloth napkins, lunchbox or reusable canvas bag rather than paper lunch bag; buy products that have little or no paper packaging when possible; use scrap paper for homework list; have a class "scrap paper box;" use both sides of paper; bring snack drink in a plastic cup with a lid instead of a drink box, etc.) The class may want to make a poster of the ideas to display as a reminder.
3. Discuss how others could help save paper if they were aware of the possibilities. In teams, have each group decide what they could do to encourage careful use of paper by others. Give time and materials for preparation and practice. (Could do a skit, a rap, a poster, a chart, a song, etc.)
4. Present them to other classes.

What Now?

1. Think of substitutes for other products we throw away.
2. Think of other uses for these products that would prolong their useful life.

Everything Old Is New Again

Grade Level : 3

Subjects:
Science 2.3
Social Studies 2.3, 5.3, 8.2, 9.2, 9.4

Time:
thirty minutes to mix ingredients, wait one day, then thirty minutes to prepare pulp, dry overnight, then use.

Setting:
classroom

Materials:
large mixing bowl, small pieces of used papers, starch, mixer, screen, flat pan, newspapers, soft drink bottle

Skills:
following directions, explaining, predicting, observing, creating

Vocabulary:
slurry
pulp

Source:
Weekly Reader's "Exploring the Environment"

Summary: Students will recycle used paper into new, usable paper.

Objective: Students will be able to verbalize how recycled paper is made and explain why it is important to use recycled paper.

Background: The water-to-paper ratio should be 4:1. Slurry is the mushy water and paper mixture used to make new paper. It is also called pulp.

Leading Question: What actually happens during the recycling process?

Procedure:

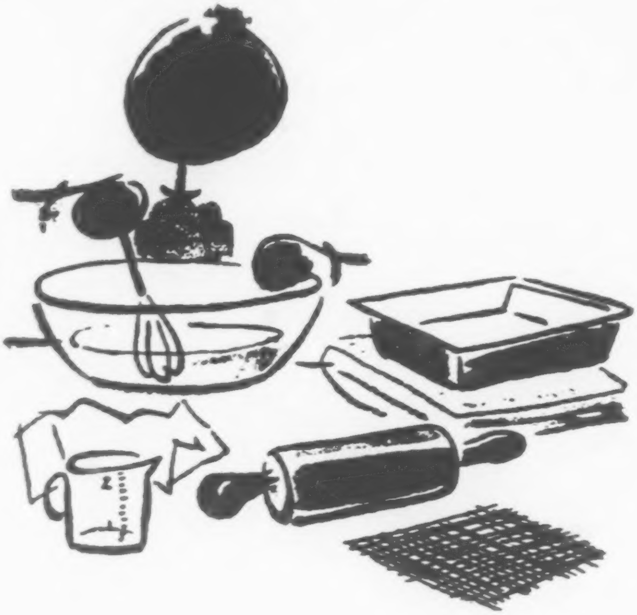
1. Since paper takes up 30% to 40% of the space in modern landfills, it is important to recycle it whenever possible instead of tossing it away. To see what happens during the recycling process, the class (or each team) will make some recycled paper.
2. Follow the "Simple-to-Make Recycled Paper" directions on the next page. (One batch for the whole class may be made or you may wish to supply each team with necessary materials to make their own batch.)
3. After the recycled paper dries, write recycling poems on it or draw on it with watercolor markers or paints. Display publicly.

What Now?

1. Do research to find out how much energy is used in the regular paper-making process.
2. Find out what kinds of paper can be recycled.
3. Try making recycled paper adding such items as small feathers, grasses, seeds, and seed pods, thread, small flowers, pieces of colored construction paper, food coloring, etc.
4. Find out if your school uses recycled paper for letterhead or student exercises. (Schools are required to report by October 1 of each year the amount of recycled-content paper and paper products purchased each year or you may call the Division of Pollution Prevention and Evnironment Assistance at (919) 715-6500 or (800) 763-0136 for information on your school.)

Everything Old Is New Again (Continued)

SIMPLE-TO-MAKE RECYCLED PAPER



What You Need

- lots of used white paper, newspaper, or telephone book paper
- a large bowl
- 4 cups of water
- an eggbeater or a whisk
- a flat baking pan
- 1 teaspoon of starch, if needed
- a piece of window screen that fits inside pan
- two thick layers of newspaper
- a rolling pin or a full, 1-liter soft-drink bottle

What to Do

1. Tear used paper into very small pieces, about the size of a dime. Cover with warm water. Let the mixture sit overnight.

2. The next day, use the eggbeater or whisk to beat the water and paper mixture until it looks like mush. This mush is called slurry. A teaspoon of starch may be added if slurry is too runny.

3. Put the screen into the flat pan and place slurry on the screen. For smaller pieces of recycled paper, place about 1 cup of slurry at a time on the screen. Drain and dry in the regular way.

4. Lift the screen slightly. Let it drain for a few minutes. Place the screen, pulp side up, on a thick layer of newspaper. Put another layer of newspaper on top.

5. Roll the rolling pin or soft-drink bottle over the newspaper to squeeze the water out of the pulp. Turn the pile over. Carefully remove the newspapers and then the screen. Let the pulp dry.

What Goes Around...

Grade Level : 3

Subjects:
Science 2.1, 2.4, 2.10, 4.2
Social Studies 4.2, 9.4, 10.1
Math 3.3
Communication skills 2.2, 4.2

Time:
thirty minutes

Setting:
classroom or outside

Materials:
rolled up newspaper, game instructions, role labels with strings/yarn

Skills:
sequence, analyze, observe, explain, role play, follow directions, draw conclusions

Vocabulary:
conserve
cycle
environment
recycle
plant (as in recycling plant)

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will play the "Dead-End vs. Cycle Game" and discuss the impact recycling has on the environment.

Objective: Students will be able to explain how recycling helps conserve natural resources.

Background: As recycling becomes more prevalent, some jobs on the dead-end route will be lost; but new jobs will open up along the recycling route.

Leading Question: What is a cycle and how can it help us save natural resources?

Procedure:

1. Introduce the "Dead-End vs. Cycle Game" by telling the class they are going to act out the life of a newspaper to see how it can affect their community's solid waste stream and natural resources.
2. Distribute role labels to all students. (Using the strings, they hang them around their necks.) Place them in a straight line from Forest to Landfill discussing possible actions each could do when the paper is passed to them (the logger saws, the logging truck is driven, etc.). (Sound effects could be used. Suggestions are in quotation marks.)
3. Play the game, then discuss its implications. Broaden their thinking by asking if newspaper is the only product this game works with.
4. Ask various individuals to explain what this game tells us about taking care of our natural resources. Listen to explanations to check for comprehension.

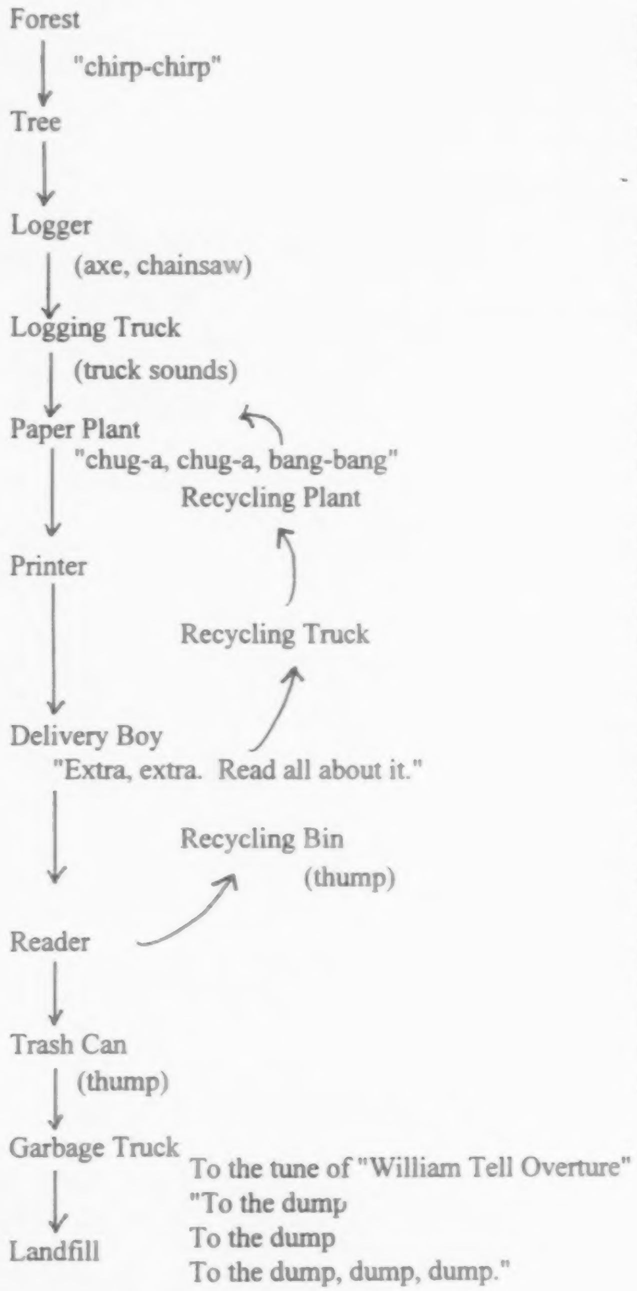
What Now?

1. Have students illustrate a "dead-end" and "cycle" for some product other than a newspaper. As they finish, they explain it to another classmate who is finished.
2. Ask: Is there anything in our trash can that shouldn't be there? What should we do about it?

3.5

The Dead-End vs. Cycle Game

All students in the class can participate in this game. If possible, play in a space big enough for students to make a circle. The object of the game is to illustrate the problems with a Dead-End solution to waste (wasted trees and too many landfills), and to show how a Cycle and Recycle approach can solve these problems. Each student wears a sign around his/her neck showing which role he or she plays.


Forest
"chirp-chirp"
Tree
Logger
(axe, chainsaw)
Logging Truck
(truck sounds)
Paper Plant
"chug-a, chug-a, bang-bang"
Recycling Plant
Printer
Recycling Truck
Delivery Boy
"Extra, extra. Read all about it."
Recycling Bin
(thump)
Reader
Trash Can
(thump)
Garbage Truck
To the tune of "William Tell Overture"
"To the dump
To the dump
To the dump, dump, dump."
Landfill

First, the children act out a Dead-End. Begin with all the Trees standing together in a forest, and all the Landfills sitting together. Send a rolled up newspaper through the steps in the illustration from Forest to Landfill. Each time a Logger cuts down a Tree, the Tree sits down. Each time the paper goes into the landfill, a Landfill stands up.

After running through this cycle a few times, ask the children to notice what is happening. (There are few or no Trees, and the Landfill is getting bigger).

Next, change the Dead-End to a Cycle, using recycling. Begin with all the Trees standing, and the Landfills sitting. A Logger cuts down one Tree, which goes on the Logging Truck to the Paper Plant, and so on through the cycle until it comes to the Reader. This time, the Reader throws the paper into the Recycling Bin instead of the Trash Can.

The Recycling Truck picks up the paper and takes it to the Recycling Plant, where it is made into recycled paper. The former Logging Truck, which is now a Recycling Truck (turn sign over) carries this recycled paper to the Printer, where it is made into a newspaper. This newspaper can keep making the rounds and being recycled. Ask the children how this is different from the Dead-End. (Trees are still standing, and the Landfill is not growing.) Former Loggers can be put to work as workers in the recycling plant (turn their signs over).

tree	**landfill**
tree	**landfill**
tree	**landfill**

For use with "What Goes Around..."

recycling worker **(on back of logger)**	**recycling plant** **(on back of paper plant)**
tree	**recycling plant** **(on back of paper plant)**
tree	**landfill**

logger **(on back of recycling worker)**	**logging truck** **(on back of recycling truck)**
paper plant **(on back of recycling plant)**	**printer**
paper plant	**delivery boy**

For use with "What Goes Around..."

reader

trash can

(on back of recycling bin)

garbage truck

(on back of recycling truck)

recycling truck

(on back of garbage truck)

recycling bin

(on back of trash can)

recycling truck

(on back of logging truck)

For use with "What Goes A[illegible]und..."

3.10

3 R's

Getting On The Bandwagon

Grade Level : 3

Subjects:
Social Studies 1.2, 1.3, 3.1, 5.3, 8.2, 9.4
Communication Skills 1.1, 1.2, 1.3, 2.1, 2.2, 2.3, 3.1, 4.2

Time:
two class periods to prepare
time to present to all other classes

Setting:
classroom
school assembly or all other classrooms

Materials:
examples of advertisements, 14 x 11 poster board for several teams, cardboard scraps

Skills:
evaluating, organizing, presenting, analyzing, speaking

Vocabulary:
reduce
reuse
recycle

Source:
Watauga County Recycling Curriculum Committee

Summary: The class will plan, prepare, and present a variety of class projects designed to encourage others to reduce, reuse, and recycle.

Objective: Students will communicate with other students in the school about important reasons to reduce, reuse and recycle.

Background: The comraderie between students can act as a powerful force to encourage positive, constructive behaviors. In this activity, students will be using their influence with other students to persuade them to reduce, reuse, and recycle.

Leading Question: What can we do to get others to reduce, reuse, and recycle?

Procedure:

1. Now that the class knows about solid waste problems, they are ready to encourage others to help them reduce the amount of waste produced. Each team will work on one of three projects. Projects can be assigned by the teacher or chosen by the teams.

2. Hand out the attached direction sheet "Positive Projects" and explain each of the three projects. Divide projects among teams, make materials available, and begin work.

3. Present the projects to other classes in the school either at an assembly program or by visiting other classrooms.

What Now?

1. Think of ways to encourage reducing, reusing, and recycling at home, office, church, scouts, etc.
2. Hold a school-wide or grade-wide toy swap.
3. Research the amount of material that was recycled at your school before your projects and after completion of "Getting on the Bandwagon."

POSITIVE PROJECTS

These projects are designed to encourage others to reduce the amount of waste they produce, to reuse what they have, and to recycle as much as possible once things are no longer needed.

1. Make and decorate a large cardboard question mark, then attach it to the large clip. This will be put on the class trash can to make people stop and ask themselves these questions: "Should I throw this away or is there something else I could do with it?" "Can I recycle it?"

   Make question mark clips for other classes. Prepare an informative lesson to teach each class that receives a question mark. Be sure the lesson is quick, interesting, and contains information about why and how one should recycle certain items.

2. As a class, make up short rhymes about reducing, reusing and recycling. Then put the best rhyme on 11 x 14 poster board in an eye-catching, easy-to-read way. Make several for other classes (laminate them). Discuss very thoroughly what the rhyme means and prepare a catchy lesson about its meaning for the classes who receive a sign from you.

3. Look at several ads and discuss what makes a good ad. Then create your own ad to share with other classes encouraging them to reduce, reuse, and recycle materials.

NATURAL RESOURCES

Waste In Time

Grade Level : 3

Subjects:
The Arts 3.1
Communication Skills 2.1, 2.2
Social Studies 7.3, 11.1
Science 1.2, 2.4, 4.2

Time:
two class periods

Setting:
media center, classroom

Materials:
sources of information, assignment cards

Skills:
research, compare, analyze, organize information, presentation, cooperation

Vocabulary:
Native American
conserve
natural resource
consumption
appliances
discard

Source:
"Here Today, Here Tomorrow...Revisited"
New Jersey Dept. of Environmental Protection

Summary: Teams of students will research various aspects of early Native American life and compare their conservation habits with those of present day Americans. Teams will share their information.

Objective: Students will learn to appreciate the limited waste produced by early Native Americans.

Background: The buffalo serves as a prime example of how early Native Americans cared for the earth and the resources available to them. They took food, clothing, weapons, shelter, and tools from the buffalo and in return, they gave respect, reverence, and protection.

Leading Question: How does the use of natural resources by early Native Americans compare with Americans today?

Procedure:

1. On day one, grab students' attention by asking: "Do we recycle more materials than the early Native Americans did?" (yes) "Does that mean we use natural resources more wisely that they did?" (no) Our job is to prove what we say. Divide students into 7 groups giving each team an assignment card to research from the "Waste In Time Activity Cards."

2. Allow time to gather and synthesize information. Then the team prepares a report and illustration to share with the class.

3. On the next day teams present their reports to the class.

What Now?

1. Write about what archaeologists in the year 2500 would learn about our culture from our trash piles. (Resource: Rubbish! The Archeology of Garbage, by William Rathje and Cullen Murphy, Harper-Collins Publishing.)

2. Invite a Native American to speak with the class about their ideas on using natural resources.

WASTE IN TIME ACTIVITY CARDS

1. List the variety of foods consumed by present-day Americans and by early Native Americans.

2. Select a plant food and a piece of meat from the early Native American culture and also from today's American culture. Trace the path of each from soil or animal to the serving plate including packaging, transportation, home preparation, etc.

3. List the trash produced from the production, transport and consumption of a typical early Native American food and that produced by a popular present-day American food.

4. List the tools and/or appliances that were used to produce, sell, and prepare a typical early Native American food and then list the tools and/or appliances that are used for a popular present-day American food.

5. List the materials and equipment used to prepare early Native American clothing and then list materials and equipment used to prepare present-day American clothing.

6. Tell why, when, and how clothing items were discarded by early Native Americans and by present-day Americans.

7. List the kinds of toys used by early Native Americans and by present-day Americans. What materials were/are used to make each toy listed. Is it a renewable resource? What happens to it when people are finished using it?

NATURAL RESOURCES

From Beginning to End and Then...?

Grade Level : 3

Subjects:
Social Studies 2.3, 9.3, 9.4, 10.1
Communication Skills 2.2, 4.2
Math 3.1, 3.3
Science 2.2, 2.6, 2.7

Time:
one hour

Setting:
classroom

Materials:
16 3x5 cards for Cycle Game

Skills:
sequence, listen, follow directions, work cooperatively, synthesize, note taking, classify

Vocabulary:
manufacture
source
transportation
cycle
synthetics
processing
bauxite
lime
fossil fuels
soda

Source:
Rethinking Recycling
Oregon Dept. of Environmental Quality; Portland, OR

Summary: Students will have a short lesson on the source of various materials and the process(es) involved in their production. Then students will play a card game which applies the information just learned.

Objective: Students will be able to apply knowledge about the sources of everyday items and what becomes of them in the future.

Background:

1. Aluminum Can: Bauxite is mined (fuel for mining equipment) in other countries, shipped (fuel for ships) to the United States, and transported (fuel for trucks) to factories where the aluminum is separated from the bauxite. The melted aluminum is poured into flat sheets and sent (fuel for trucks) to a can factory. There the sheets of aluminum are shaped into cans.*
   Using recycled aluminum reduces the need for bauxite ore. (Aluminum foil must be recycled separate from the cans.)
2. Glass Bottle: Sand, soda, and lime are mined (fuel for mining equipment) from three different mines. These minerals are transported (fuel for trucks) to glass-making factories where it is mixed together and melted (fuel to heat the mixture). The hot liquid glass is poured into molds which shape the bottles. The bottles are then sold and sent (fuel for trucks) to a bottling company that fills it with their product.*
   Broken recycled glass is called cullet. Using cullet reduces the amount of raw materials used in producing new glass bottles.
3. Piece of Paper: Trees are logged (fuel for logging equipment) from forests and transported (fuel for trucks) to a lumber mill where logs are sawed (fuel to operate saws) into boards. The scraps and sawdust are transported (fuel for trucks) to a paper mill where the scraps are ground up (fuel for grinders) and mixed with chemicals to make a gooey pulp. Pulp is rolled out into large, flat sheets. Later it is cut into pieces. *
   Using old paper to make the pulp reduces the number of trees needed to make new paper.
4. Plastic Toy: Fossil fuels (oil) and natural gas are pumped (fuel for the pumps) from the ground and pumped to refineries where it is heated (fuel for the heat) and treated with chemicals (transported in from somewhere else) to make resins. Resins are transported (fuel for trucks) to manufacturing plants to be melted (fuel for heat) and shaped into plastic toys.*
   Most plastics are thrown away but some are melted, heated, or chopped to make other plastic items.
   All synthetic materials (nylon, rayon, acrylic, polyester, etc.) are made from fossil fuels.

From Beginning to End and Then...? (Continued)

5. Plants and Animals provide:
Cotton (plant), silk (worm silk), foods, linen (flax plant), wool (animal fur), leather (animal hide), rubber (tree sap).

*Once a product is made at the factory it is usually transported (fuel for trucks) to a distributor who sells some of the goods to a store. The order is sent to the store by truck (fuel). The store must hire salespeople (fuel to come to work) to help the customers who drive (fuel) to the store to buy things.

Leading Question: Where do objects come from and how did they get here? Where do they go from here?

Procedure:

1. Show the card game and tell the class they will play it as soon as they get the background knowledge they must have to play. Be sure they understand that the more background information they have, the higher their score will be.

2. Hold up a wooden ruler, a can, a bottle, a piece of paper, a plastic toy, a cotton ball, a leather shoe. Using the background information, give a mini-lecture for each object telling what it is made of, how the raw material was gathered, processed, where it went so you could buy it, and what will happen to it next. You might want to either have students take notes or you may want to organize the information on the board as you go using a chart similar to this:

Product	Raw Material	Gathering Materials	Processing Materials	Distributing	Selling	What Next?	Times Transported
Paper	trees chemicals water	logging	lumber mill paper mill pressing cutting printing folding	sent to supplier	to stores I go buy	recycle	5

3. Then give the directions for the "Cycle Game" and begin playing. Evaluate the level of understanding by listening to answers given during the game. Clarify any misconceptions.

What Now?

1. On a sheet of paper with one large circle drawn on it, have students draw all the steps in the cycle of a given product including all processing steps and all transportation.

2. Let students make their own "Cycle Game" cards to take home.

THE CYCLE GAME

This game helps students understand the meaning of cycles in general, and recycling cycles in particular. Put the name of one object on each 3 x 5 card.*

tin can
T-shirt
steak
eraser
synthetic clothes
green beans
aluminum foil
metal scissors
paper
wool sweater
glass vase
book
eggs
marbles
lumber

As you show each card, decide as a class if it is made of a renewable resource or a nonrenewable resource.

- Make a stack of the 3 x 5 cards. Add one extra card that says CREATIVE CARD on it. Place the cards face down in a pile.
- Divide the class into teams of four players.
- Have a student from one of the teams select a card. Give the team 30 seconds to list the steps of a cycle in proper order. (They may want to write the steps down to keep them straight.) The person who drew the card reports the answer.
- One point is given for each step in the cycle, but to be a valid cycle, at least three steps must be given. You can keep score, or assign a student to be scorekeeper.
- An extra point is given if the student can tell if the cycle involves a renewable or nonrenewable resource.
- After the first team has used a card, go to each team in turn, until each member of each team has given an answer, or until your time limit is reached.
- If the CREATIVE CARD is drawn, that student may pick any cycle that has not already been used. A CREATIVE CARD cycle is worth 2 points for each step.
- The winning team is determined by total points.

*Reuse cards from some other activity, use scrapcards from a local printer, or cut up paper used on one side to make the game cards. The more examples you cite of effective waste reduction, the sooner students learn the concepts!

What's It Made Of?

Grade Level: 3

Subjects:
Science 1.5, 2.1
Social Studies 2.3, 8.2, 9.2, 9.4
Communication Skills: 2.2, 4.2

Time:
forty-five minutes

Setting:
classroom

Materials:
a sheet, one worksheet per cooperative group, one resource label per student, one product label per student

Skills:
classify, identify, cooperate, communicate, observe

Vocabulary:
natural resource
fossil fuels

Sources:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Rethinking Recycling
Oregon Department of Environmental Quality

Summary: Each student will experience being changed from a natural resource into a commonly used product. Then students will use this information to classify many products into the 4 natural resource categories.

Objective: Students will be able to identify the natural resources from which a variety of goods are made.

Background: Everything we make, use, and throw away comes from the earth. The 4 natural resource categories are minerals/oil, minerals/rock, plants and animals.

Leading Question: Where do the things we use come from?

Procedure:

1. Build a "change machine" of chairs with two students at the sides playing the roles of electricity and gas. As a student enters the "change machine," electricity and gas make machine-like noises.

2. Call one student at a time to the back of the machine where (s)he receives a 2-sided sign, one side with a natural resource and the other with a resulting product. The student displays the resource as (s)he enters the change machine and flips it over to display the finished product as (s)he exits the front of the change machine.

3. After each student has a turn, the class will discuss which of the products are recyclable. Provide examples of products that could be made of such recycled materials.

4. Finally, without looking on the back of the labels, have each student come put his/her card into the correct resource group.

5. For further practice, each cooperative team will complete the "Resource Change Machine" worksheet.

What Now?

Carry the discussion a step further by asking about resources used in such products as a 3-ring notebook (metal, plastic, and paper), a lamp with a paper shade, a bed, etc.

RESOURCE CHANGE MACHINE

(Resources) *Mineral/Oil*	*Animal*	*Mineral/Rock*	*Plant*

Cut out each product below and glue onto the chart above.

metal fork	diamond ring	paper cup	fur coat	milk jug
baggie	glass jar	toaster	jeans	soda can
silk skirt	apple	chalk	wooden chair	milk
leather boots	toothbrush	nylon shirt	cottonball	book
cement	Frisbee	football	aluminum pie pan	Kleenex
ham	magazine	wool scarf	eggs	gasoline
sunglasses	polystyrene cup			

For use with "What's It Made Of?," 1 sheet per team

Packaging: Waste Or Wonderful?

Grade Level: 3

Subjects:
Social Studies 2.3, 5.3, 8.2
Math 4.2, 6.1
Communication Skills 2.1, 2.2, 2.3

Time:
three class periods

Setting:
media center, classroom

Materials:
research worksheet
6' piece of butcher paper
magic markers (1 set)

Skills:
gathering and organizing information, explaining, analyzing data, summarizing, graphing, presenting, drawing conclusions, comparison

Vocabulary:
biodegradable
reusable
recyclable
natural resource
renewable natural resources

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will investigate various materials used for packaging and draw conclusions about which are best for the environment.

Objective: Students will be able to identify which resources would be better to use for packaging.

Background: Some packaging such as plastic and metal are made from nonrenewable, limited resources. None of these types are biodegradable, but at least most are recyclable.

Leading Question: What materials would be best to use as packaging?

Procedure:

1. Divide the class into 5 teams, assigning one of the following types of packaging to each team: aluminum can, plastic bag, cardboard, tin can, glass bottle.
2. Using the "Digging Into Packaging" worksheet, teams will find answers to the questions.
3. After analysis, discussion, and preparation, each team will report their findings to the rest of the class.
4. The whole class plans how to organize a large graph comparing packaging information. Draw the graph on butcher paper inserting color coded information about each of the 5 types of packaging studied. (Perhaps all positive aspects could be one color, negative aspects another color, and neutral aspects a third color.)
5. The class concludes which packaging material(s) would be best to use and why.
6. This can lead to "Birthday Package Investigation" for the remainder of the year. Ask class members to bring one of their unopened birthday presents to school on their birthday (with parent permission). The child opens the gift and the class analyzes the amount and kinds of packaging used. Discuss how to reduce, reuse, and recycle the materials.

What Now?

1. Show a package made of several different raw materials. Pose the question: Why would it be hard to recycle this package?
2. Brainstorm specific ways to reduce the amount of packaging one buys.

3.20

DIGGING INTO PACKAGING

(Research Worksheet)

I am a(n)____________container or package. Find out all about me by digging into books and magazines that have the answers to these questions.

1. **Name different products I might contain.**
2. **Describe me.**
3. **What natural resource(s) do I come from? Are my natural resources renewable?**
4. **Are large amounts of this/these natural resource(s) available?**
5. **How do companies remove the natural resource(s) from the earth and what affect does this removal have on the earth?**
6. **Does it take large amounts of energy to produce me? How much energy does it take to produce one pound of me?**
7. **Am I easily recycled or am I thrown away after use?**
8. **Am I biodegradable? How long does it take?**
9. **How could I be reused?**
10. **Do you think I am a good container?**

For use with "Packaging: Waste or Wonderful?" - One per team

"Litter"ally a Mess

Grade Level: 3

Subjects:
Science 2.3
Social Studies 2.3, 5.3, 8.2
Communication Skills 2.1, 2.2, 4.2, 4.3

Time:
one hour for the lesson, several weeks for the experiment(s)

Setting:
school grounds, classroom

Materials:
worksheet, crayons, garbage bag, glass gallon jar 2/3 full of water, battery operated tape player with a rap beat tape

Skills:
poetry, observing, collecting, drawing, conclusions, interpreting, evaluating

Vocabulary:
debris
litter
biodegradable
decompose

Source:
Ripples: A Big Sweep Elementary Activity Guide
Carla B. Burgess
UNC Sea Grant College Program

Summary: Students will collect various pieces of litter as they walk around the school property making up short raps for each piece as they go. Then back in class they will discuss the effects of litter and will conduct experiments.

Objective: Students will discover the long term harm litter causes to the environment.

Background: Litter not only looks bad but also can harm wildlife and people that come in contact with it. As some litter decomposes, harmful minerals can enter streams and soil. Other debris takes hundreds of years to decompose.

Leading Question: Why is litter bad for our environment?

Procedure:

1. Take the class on a 15-minute Litter Search on the school grounds as you play a rap beat on a tape player. When a student finds a piece of litter (s)he picks it up and makes up a rap about it, then places it in the garbage bag.

   Samples:

   Soda can
   In my hand
   Won't go away
   Here to stay.

   Here lies a piece of gum
   Throwing it here was
   Pretty dumb.

2. Back in class brainstorm how litter harms the environment. Ask leading questions if they have trouble finding ideas. Share the decomposition chart on the next page. Encourage the use of appropriate vocabulary. Place some items in the jar of water to observe daily changes over a 2-week period. Have each team record responses on the "Litter in a Stream" sheet over the two week period.

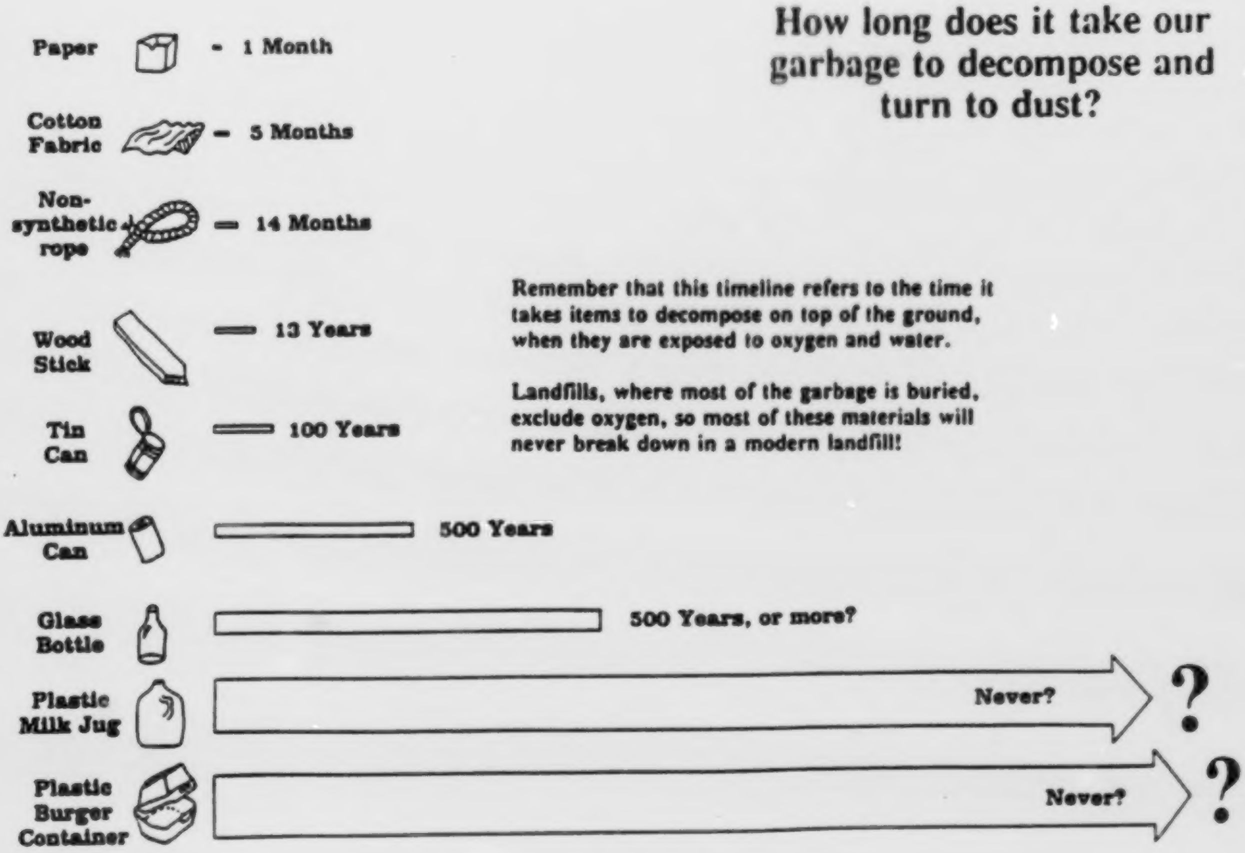
3. To follow up, have each student complete the " 'Litter'ally Searching" Worksheet. Circulate, asking questions about decomposition of the litter and potential hazards they create.

What Now?

1. Plant a "Litter Garden" with some of the litter collected on the walk. In a windowbox liner filled with soil, "plant" a metal object, a vegetable item, a piece of cotton fabric, a scrap of paper, a plastic object, a piece of glass, and some Styrofoam. Label each spot and make a hypothesis which object will decompose fastest. Dig each item up every 3rd or 4th day to check for changes.

2. Write, rehearse, and present to others in the school anti-littering public service announcements.

How long does it take our garbage to decompose and turn to dust?



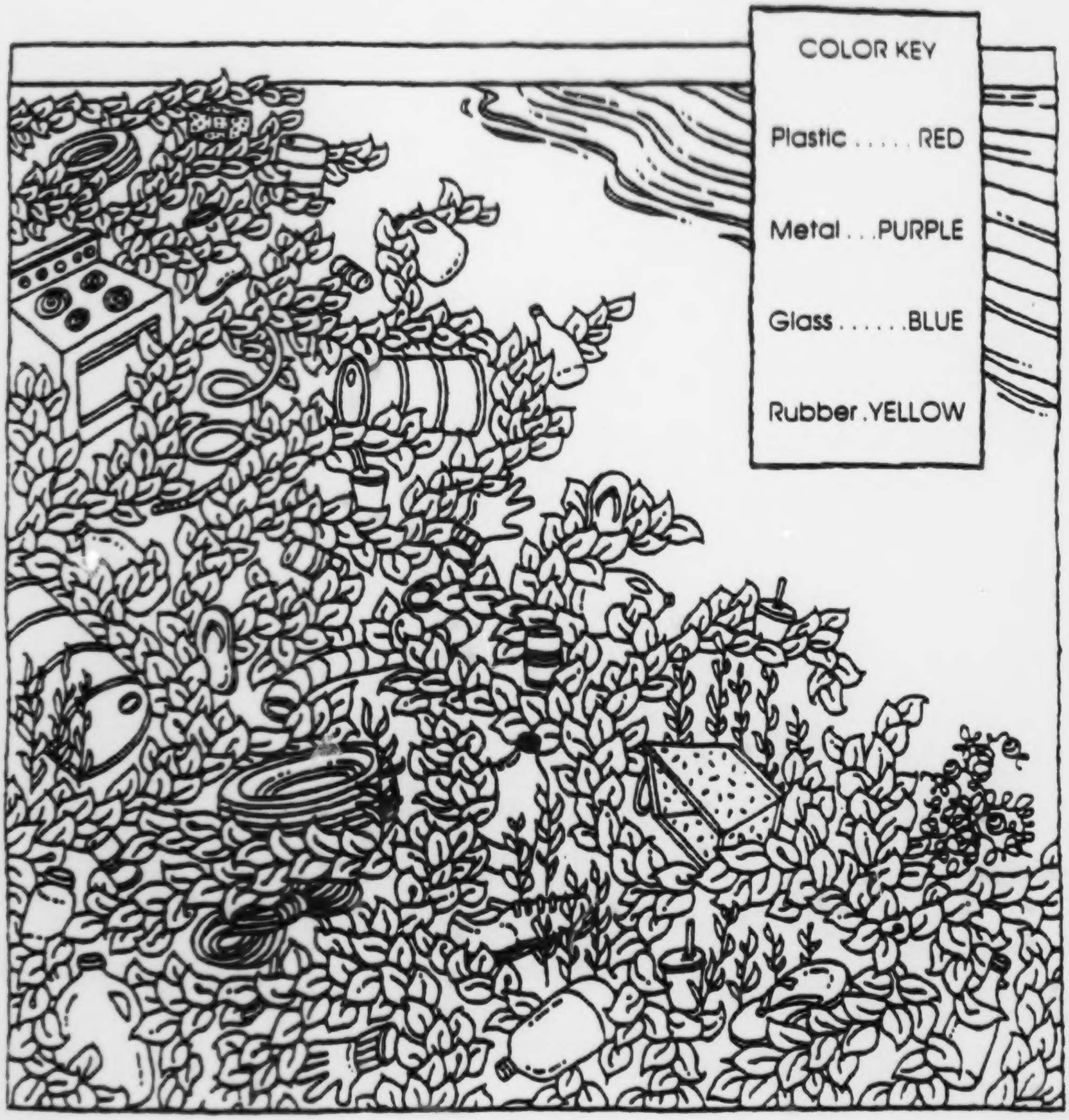
Remember that this timeline refers to the time it takes items to decompose on top of the ground, when they are exposed to oxygen and water.

Landfills, where most of the garbage is buried, exclude oxygen, so most of these materials will never break down in a modern landfill!

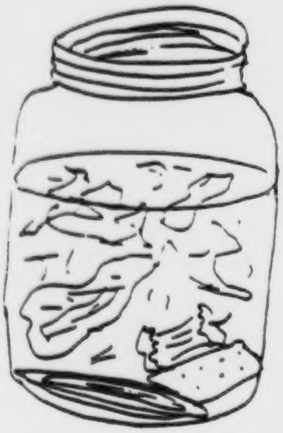
"Litter"ally a Mess
(continued)

"Litter"ally Searching

Using the key, color the debris in this shoreline picture.


COLOR KEY
Plastic . . . . . RED
Metal . . . PURPLE
Glass . . . . . . BLUE
Rubber . YELLOW

For use with "Litter"ally a Mess - one per student



LITTER IN A STREAM

Have you ever wondered what happens when litter gets into a stream? Drop some plastic wrap, fruit peelings, a tin can lid, some paper, glass and polystyrene, and a piece of cloth into a jar of water. Let it stand for about two weeks as you observe it each day.

Hypothesis: What do you think will happen in the jar?

What happened to the water?

What happened to different pieces of the litter?

Would you like to go swimming in water like this?
Why or why not?

What might happen to plants and animals who live in this water?

For use with "Litter"ally a Mess - 1 per team

Pile It On

Grade Level : 3

Subjects:
Science 2.3, 3.3,
Social Studies 2.3, 5.3, 8.2
Math 4.1, 4.3, 4.13
Communication Skills 2.2, 4.2

Time:
homework assignment two days before lesson
one class period for lesson
three to four weeks for observation

Setting:
classroom or a protected spot outside

Materials:
four 5-gallon buckets, weeds, hay, grass clippings, sawdust, coffee grounds, fruit and vegetable peelings, leaves, thermometer

Skills:
measuring, observing, analyzing, classifying

Vocabulary:
composting
aerobic
anaerobic
decomposition
mass
volume

Source:
Here Today, Here Tomorrow...Revisited
New Jersey Department of Environmental Health

Summary: Students will observe different compost piles with various deficiencies in order to learn which components are necessary for proper composting.

Objective: Students will learn the basic components of a compost pile and see the result of proper composting.

Background: A compost pile is made of organic wastes and needs nitrogen, moisture, and air to allow the organic waste to decompose over time.

Leading Question: What does a compost pile need in order to function properly?

Procedure:

1. Have the class collect and bring in a good variety of organic waste a day or two before the lesson.
2. Prior to the lesson, a few students may be asked to look up information about composting (why and how) and other vocabulary. They can share information at the beginning of the lesson. Then ask the leading question above.
3. Begin preparing the four compost piles with help from the students.
4. Drill holes in the sides of three of the buckets, near the bottom.
5. Set up the following conditions in each bucket:

Compost Bucket #1
(Compost which is low in nitrogen)
Place mostly leaves and some vegetable and fruit peels in the bucket.
Moisten, do not soak.
Turn over regularly, once every 3 days for the first 2 weeks, then once per week.

Compost Bucket #2
(Compost without enough moisture)
Place a mixture of grass clippings (high in nitrogen—make sure the grass clippings are not very wet), leaves, vegetable and fruit peels in the bucket.
Do not water.
Turn regularly.

Pile It On (Continued)

Compost Bucket #3 - The one with no holes in the side
(Compost without adequate air circulation)
Place mostly grass clippings (high in nitrogen) in the bucket.
Place a mixture of leaves, vegetable and fruit peels in the bucket.
Keep moist.
Do not turn.

Compost Bucket #4
(Compost with optimal conditions)
Layer leaves, vegetable and fruit peels, and a small amount of grass clippings in the bucket.
Keep moist.
Turn regularly.

6. Keep daily record of temperatures in the piles.
Observe for several weeks.
Discuss results after several weeks:
    Which compost is dark and crumbly?
    Which is best? What ingredients/components did it have?
    How does composting reduce the amount of vegetative waste?
    Did all piles look and smell the same?

What Now?

Apply information learned about compost piles to modern landfills. Discuss how the two differ and explain each difference.

WASTE DISPOSAL

"Our Throwaway Spree"

Grade Level : 3

Subjects:
Science 2.4, 2.6
Social Studies 2.3, 4.2, 5.3, 6.2, 6.3, 9.3, 11.1
Communication Skills 2.2, 4.2, 4.3
The Arts 1.4, 1.5

Time:
depending on the audience, the time could be from one class period to five periods.

Setting:
classroom
auditorium (optional)

Materials:
hats on accompanying pages
props (optional)
scripts

Skills:
communicate, dramatize, compare, analyze, infer, predict

Vocabulary:
represent
industrial
mass-produce
post-war age
war shortage
synthetics
rayon
nylon
acrylics
trade-ins
urban
converting
disposal

Source:

"Throwaway Three" from *Lessons From Litter* by Fay Bradley

Summary: Students will act out an historic account of trash over the ages. They may present the play to others.

Objective: Students will become aware that today's solid waste problems are likely to get progressively worse unless we act now.

Background: Managing waste disposal has changed over time. Students will recognize the importance of reducing the amount of waste they create and problems associated with its proper disposal.

Leading Question: How have our waste disposal habits changed over time?

Procedure:

1. Hold up masks that will be used and explain that everyone is going to help produce a play with a very important message. Instruct the students to carefully follow along with the play so they can discuss its message afterwards.
2. Assign roles to all students.
3. Give out props and/or masks and then proceed with the play.
4. Discuss the message of the skit and draw out the students' ideas about possible solutions to the throwaway mentality.

What Now?

1. The play could be performed for other classes or for the whole school.
2. Make a class timeline showing the evolution of our trash problem.

3.28

OUR THROWAWAY SPRFE

(Assign one person to call out all dates.)

Person 1

This is the tale of the Throwaway Spree,
Of Man and his Garbage throughout
his-to-ry;
Now they're very nice people, just like you and
me,
Who all have a problem, as you will soon see- -
What shall they do with their garbage and trash?

All

Why, throw it! Or bury it! Or burn it to ash!

Person 2 - 90,000 BC (Monkey)

I represent people when we lived in a tree.
I get rid of garbage so easily!
It's a snap! It's no problem - to me or to him.
We just let go, plop! Down through the limbs.

Person 3 - 50,000 BC (Cave Dweller)

I am a cave dweller who lives on the ground.
What do I do with old stuff all around?
Why, burn it, like meat; burn it up in the fire;
Or bury it like bones, in the muck and the mire.

All

Yes, throw it, or bury it, or burn it to ash!
That's how we always get rid of our trash!

**Person 4 - 200 BC (Roman)
(Sheet for toga/Roman Helmet)**

I am a Roman who lives in the town.
Our laws won't allow me to just throw it down.
I have to drag it away for a mile
And then I can dump it, forget it, and smile!

Person 5 and 6 - 1200 AD (Briton) (Vest and Knickers) (housewife, apron)

I am a Briton, wary and quick;
Down on our street it can get pretty thick.
When housewives up there want to pitch out their
goo, they just heave it out there and yell: "Gardy-
loo!"
(**Person 1** stands on chair and yells, "Gardy-
loo!") It will stay there and stay there until the
next rain, or until our fair London should burn
down again.

All

Oh, what do we do with our garbage and trash;
We throw it, or bury it, or burn it to ash!

Person 7 - 1630 (Settler) (Pilgrim Hat)

I am the settler. I came without much,
But everything else I must make with my hands.
So I don't throw out much - I use all I can.
Cloth scraps become quilts; I reuse my bent nails
It will be a long time 'fore the next trade ship sails.

Person 8 - 1700 (Colonist) (Coonskin Hat)

I am a colonist; now life's not so tough.
We have trade between cities that brings lots of
stuff
And some things are made by our townfolk today,
I could buy a new harness, throw this old one
away.
We have pigs and hogs running loose in our street,
If I toss it out there, they'll eat it up neat!

All

What are we still doing with garbage and trash?
You guessed it! Throw it away, or bury it, or burn it to ash!

Person 9 - 1890 (Industrialist) (Hard Hat)

I'm the industrial person and new on the scene.
I mass-produce goods with my trusty machine.
This sweater, handmade, took a week in days of yore,
But now in one hour, I can make forty-four.
I make things so cheaply, you can now afford two,
And throw out twice as much trash as you need to do.

Person 10 - 1950 (Scientist) (Lab Coat)

I am the scientific person in the new post-war age.
We've learned a few tricks while the war shortage raged. When we couldn't get natural stuff to process,
We invented synthetics to replace the rest.

Person 11 - (Hard Hat)

Rayons and nylons, acrylics and plastics,
For furniture and clothing and even elastics;
Forget your old woolens and silks and your cotton;
Real wooden toys and washboards are forgotten.

Person 12 (1960 Scientist) (Lab Coat)

Our new stuff will last 'til forever, you see
Even when it's worn out to you and to me.
Permanent pressed, pre-sized and pre-shrunk
When dingy and old, it's still permanent "junk"
(Person 1 yells, "Junk")

Person 13 (1965 Industrialist) (Hard Hat)

We make instant menus that come in a PACK
You just boil the food in its own plastic sack.
Or our TV dinner in its tinfoil tray
It's quick; you don't wash it; just throw it away!

Person 14 (1965 Scientist) (Lab Coat)

We make lots of TV's and clothes dryers, too.
don't ask for a trade-in; you're kidding, aren't you?

Person 15 (1970's Industrialist) (Hard Hat)

Our new cars all change with each model year,
Don't try to repair them, the cost is much too dear.
Besides, we don't bother to make last year's parts
For Skylarks, or Novas, or Cougars, or Darts.

Person 16 (1980 Scientist) (Lab Coat)

It's the New Thing, the NEW that America craves.
So out, out with the old stuff, away to their graves.

Person 17 (1985 Industrialist) (Hard Hat)

So what if they're more of us buying more goods?
So what if they won't rot away as they should?

Person 18-20 (Indians) (Headbands)

Now wait just a minute! You cannot fail
To include me in your historic trash tale.
We Indians lived simply, on prairies, in woods,
We made no high trash piles, nor mass-produced goods.
Let me be your critic, show you where you stand;
And tell you just how you're defiling our land.
Your new-fangled goods will not rot away,
When you throw them all down they remain where they lay.
Then you say you will bury them deep in the ground;
All your urban trash will make quite a mound!
So then you would burn it, in smoldering masses
And fill up our air with smoke, deadly gases!
Oh, all of your answers have faults everywhere;
You'll either ruin the water, the land, or the air.
What's more, your resources...your lumber...your ore...
Get smaller each year than the year before.
And what's more...this old earth's not making any more.

Person 21 (1990 Industrialist) (Hard Hat)

You're right! Our resources are shrinking away.
While our garbage problem grows bigger each day.
We're always converting resources to refuse
Instead of recycling them for reuse!

Person 22 (1992 Scientist) (Lab Coat)

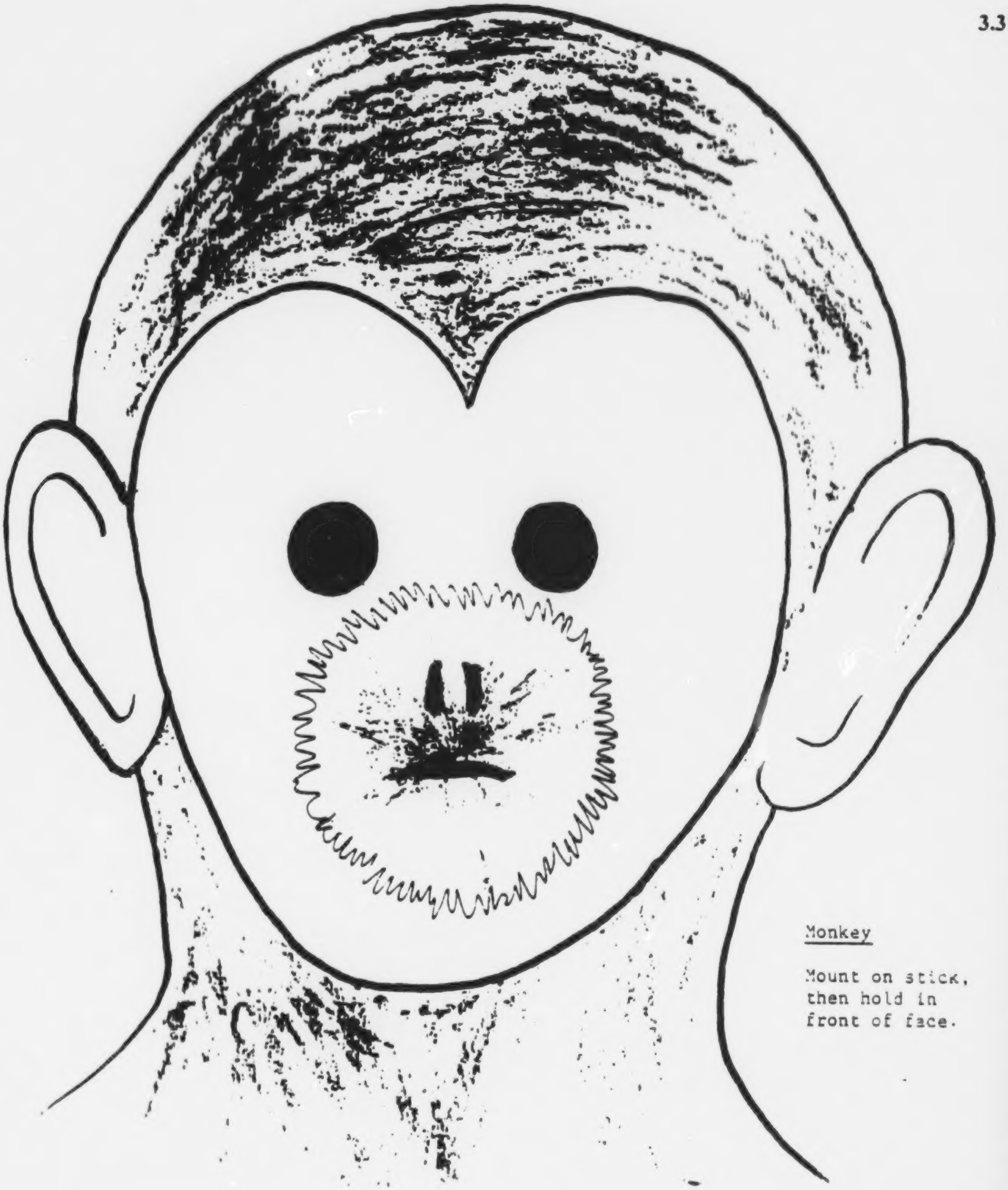
Oh stop it! Don't drop it! We'll think of a way
To make food for cows that's much better than hay.
Don't burn it, return it...we'll make something new,
A vase for your mother, a spyglass for you.
(Flower in bottle for vase, flower out, bottle held up to eye for spyglass)
Don't bury it, carry it...back to the mill.
We'll make a new blanket to ward off the chill
(Pick up old blanket and wrap around shoulders)

Person 23 (1995 Industrialist) (Hard Hat)

It's time we progress past the Disposal Age
And make recycling the popular rage!
We'll have to give up old solutions for trash
And all realize that its pure balderdash...to just...

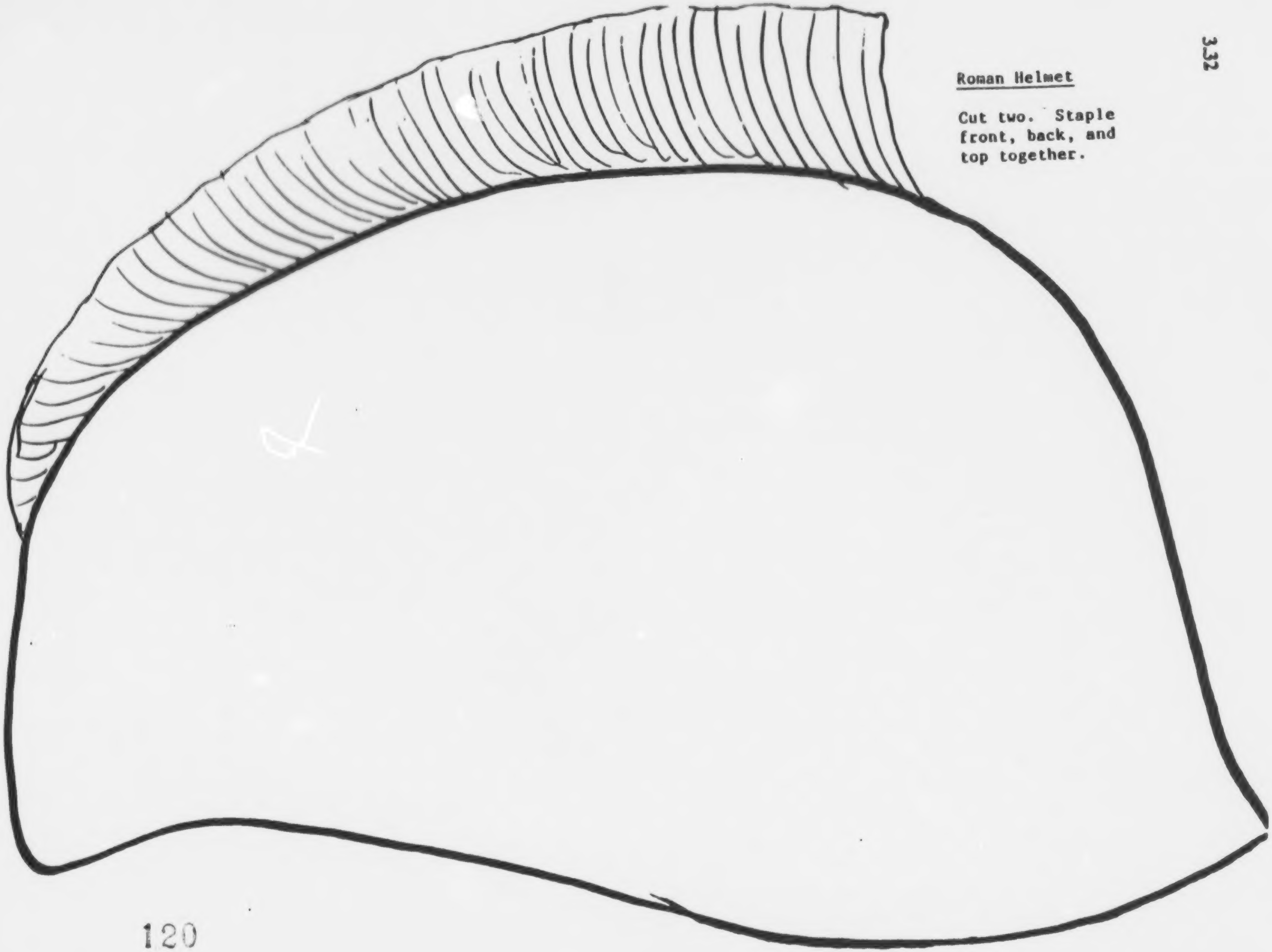
All

Throw it, or bury it, or burn it to ash!



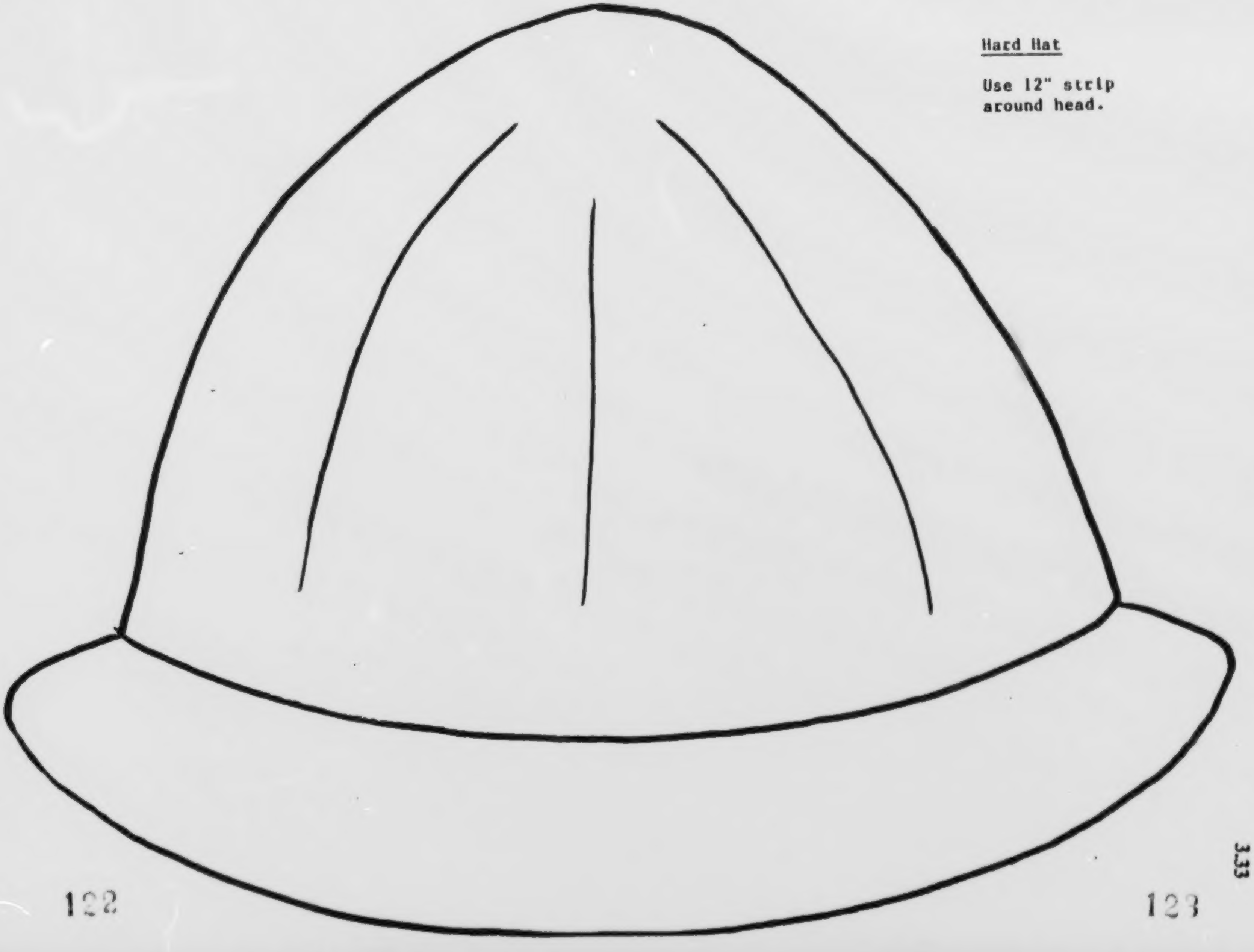
Monkey

Mount on stick, then hold in front of face.



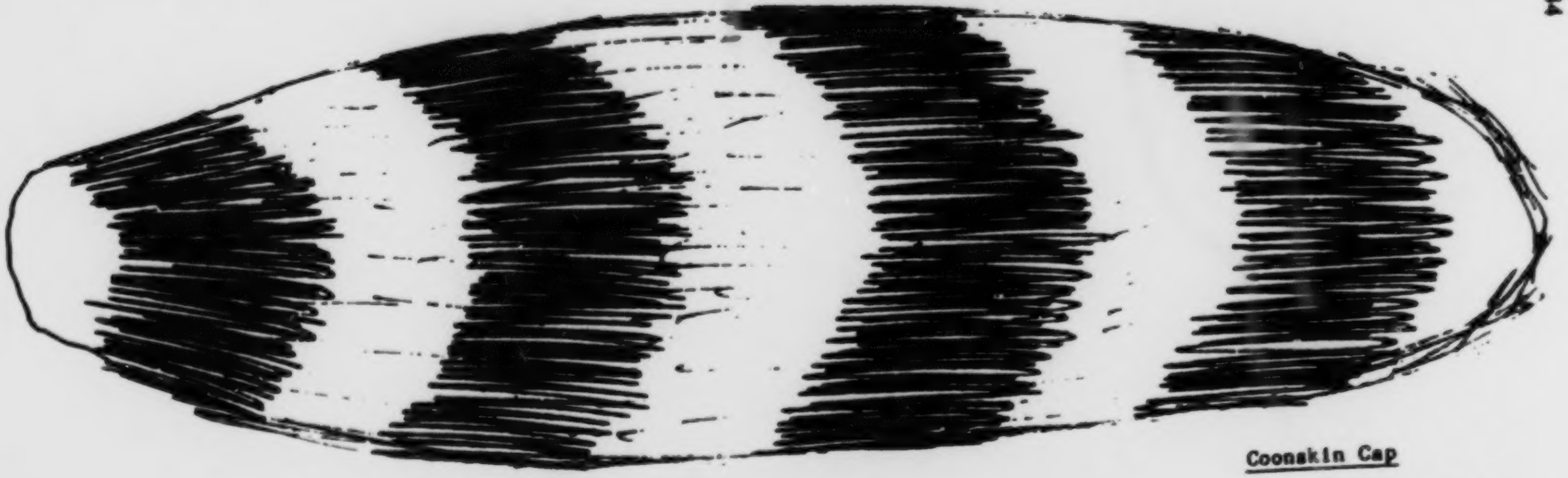
Roman Helmet

Cut two. Staple front, back, and top together.



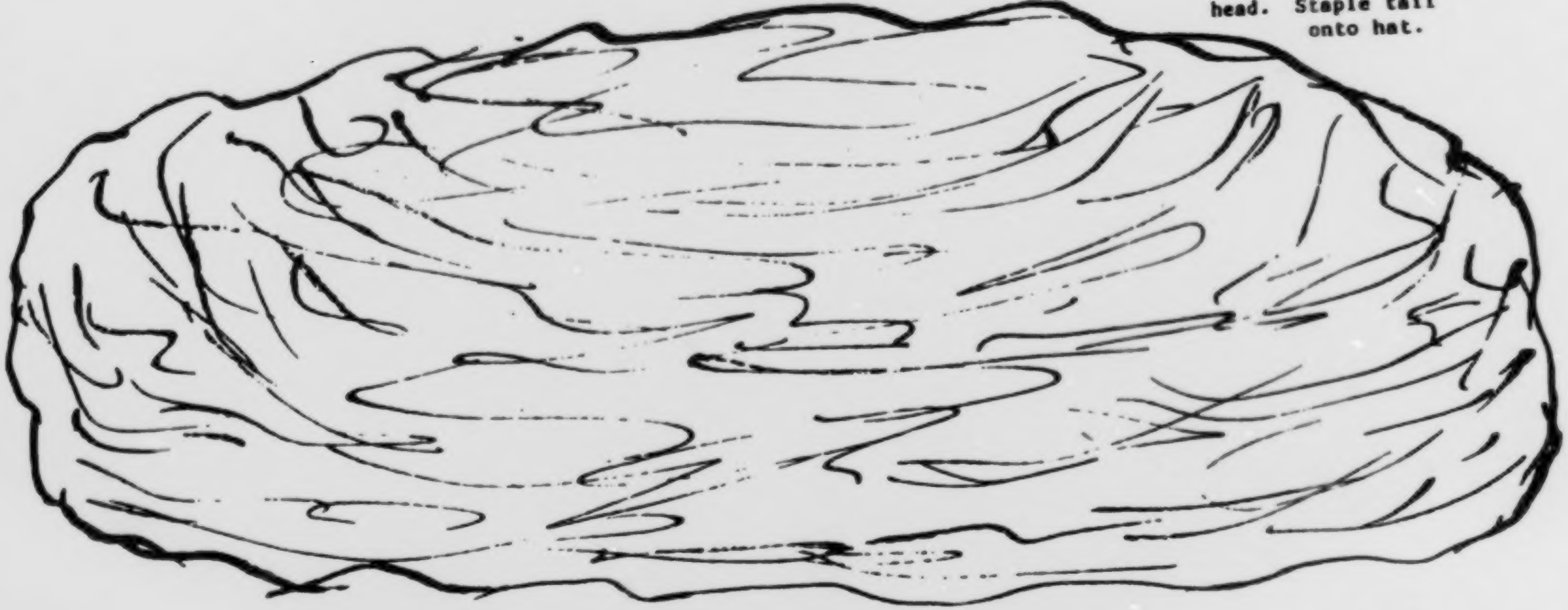
Hard Hat

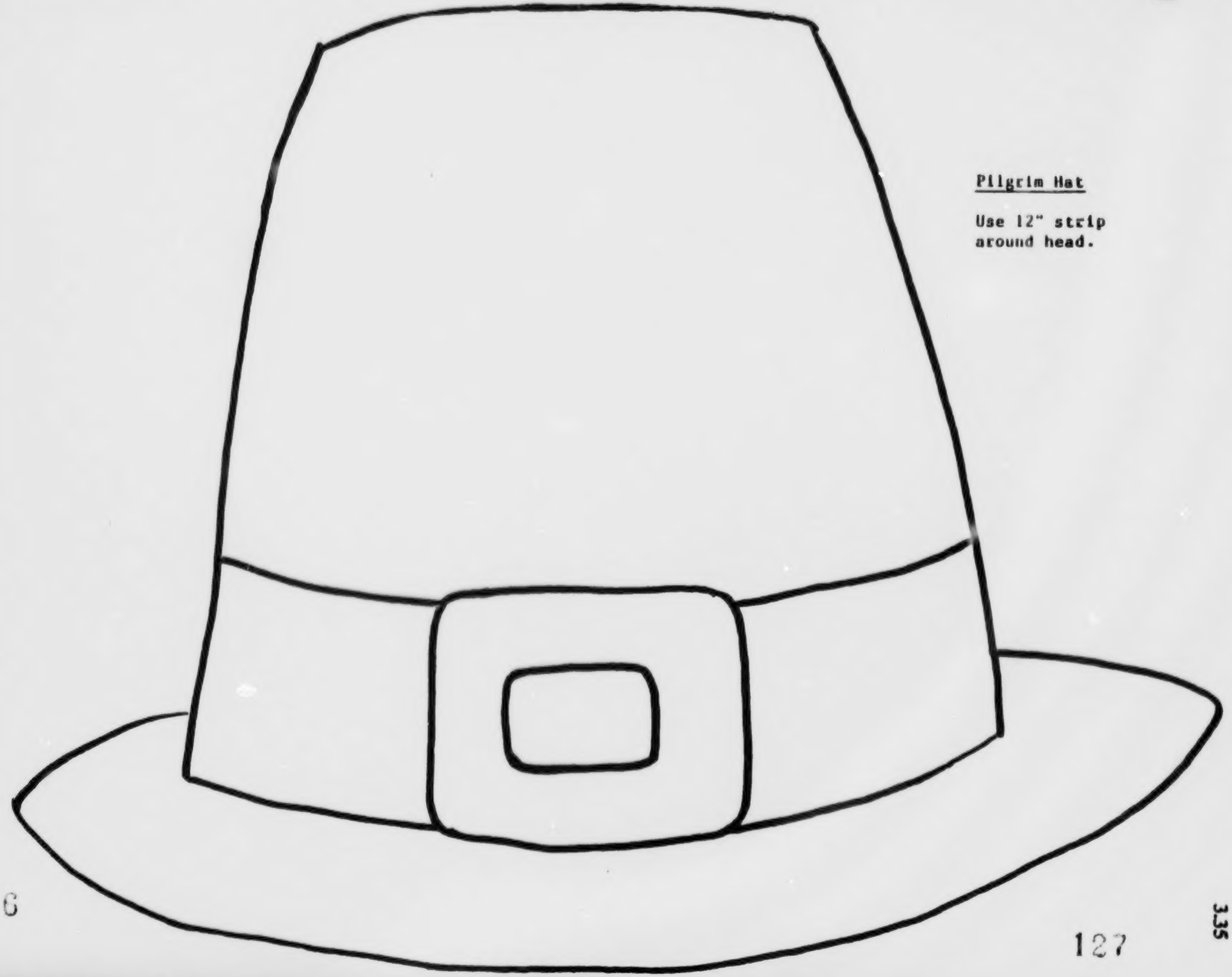
Use 12" strip around head.



Coonskin Cap

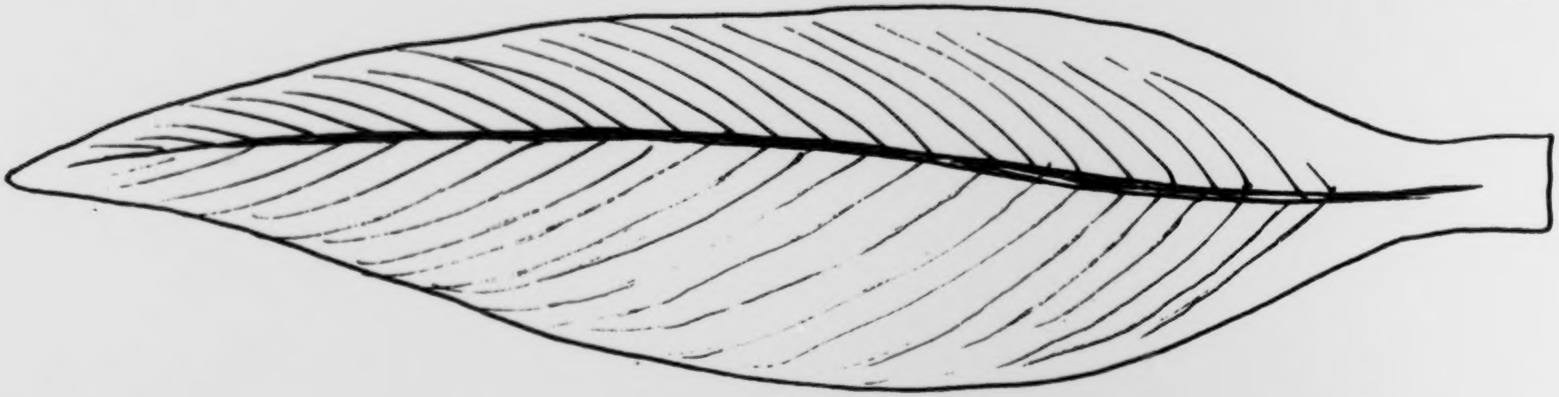
Use 12" strip around
head. Staple tail
onto hat.



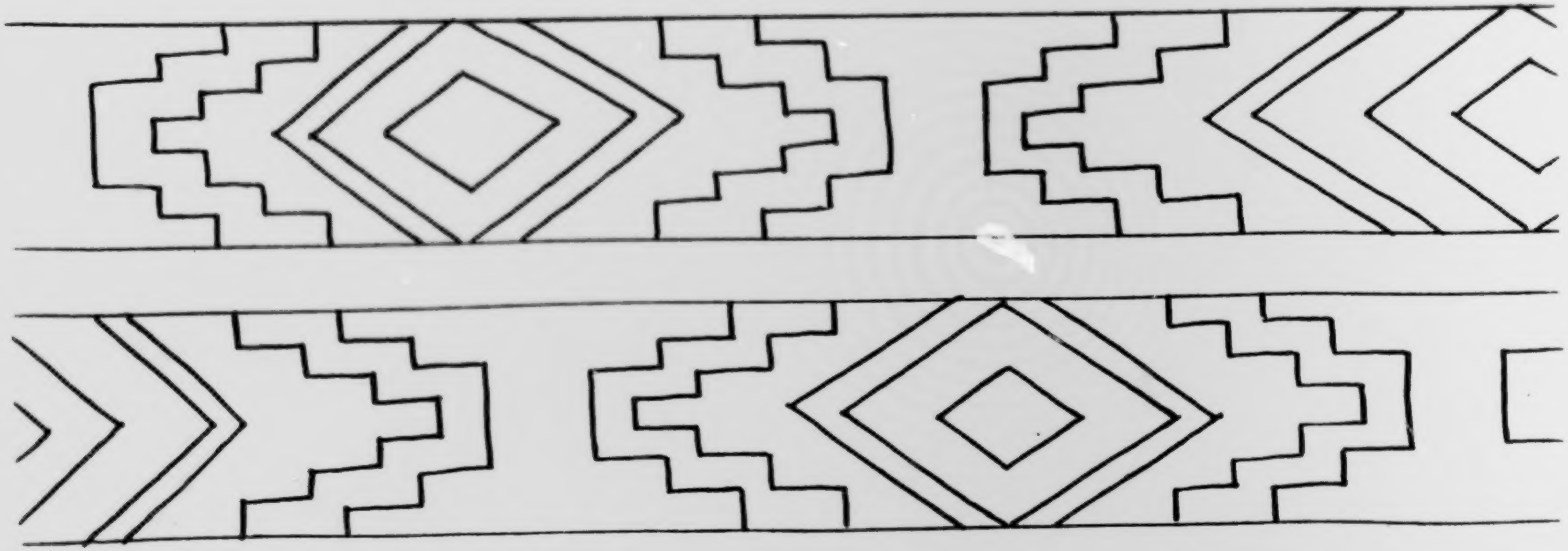


Pilgrim Hat

Use 12" strip around head.



Indian Headband



N♻C

FOURTH GRADE

TITLE	MAJOR TOPIC	PAGE NO.	SUBJECT AREAS COVERED
Digging Up The Facts	3 R's	4.1	🧩 ⚖ 👥
Wonderous Worms!	3 R's	4.2	💡 🧩 ⚖ 👥
Nature's Cycle	NATURAL RESOURCES	4.4	💡 🧩 👥
It's A Wrap!	NATURAL RESOURCES	4.9	🧩 ⚖ 👥
Simulated Landfills	WASTE DISPOSAL	4.12	💡 🧩 ⚖
Classroom Composting	WASTE DISPOSAL	4.16	💡 ⚖
To The Landfill!	WASTE DISPOSAL	4.17	👥
Council Counsel	WASTE DISPOSAL	4.18	💡 🧩 👥

Digging Up The Facts

Grade Level: 4

Subjects:
Social Studies 2.3, 5.3, 8.2
Math 6.1, 6.2
Communication Skills 2.2, 4.2

Time:
one week

Setting:
classroom
cafeteria

Materials:
large scale butcher paper

Skills:
gathering data, graphing, analyzing, comparing, drawing conclusions

Vocabulary:
solid waste
recyclables

Sources:
Watauga County Recycling Curriculum Committee

Watauga County Department of Sanitation

Summary: The students will graph the amount of solid waste produced in their county or city each year for the last 3 years and the amount of material recycled over the same time period. Students will also weigh the school cafeteria waste each day for a week. The results will be graphed.

Objective: Students will become aware of the amount of waste produced in their own community.

Background: **Example - Watauga County, NC**

	Tons of Solid Waste	Tons per Person	Tons Recycled	Percentage
1990-91	32,307	1,749	2,384	7.38
1991-92	32,882	1,779	2,755	8.38
1992-93	35,208	1,906	2,393	6.70

Call your local Solid Waste Management department for local data, the Solid Waste Section (919) 733-0692, or the Division of Pollution Prevention and Environment Assistance at (800) 763-0136.

Leading Question: How much solid waste does your county or city produce in a year and how much does the school cafeteria produce in a week?

Procedure:

1. Ask the class how much solid waste has been produced in their county or city in the last 3 years. Ask how much has been recycled in that same time period. Have the class brainstorm ways to find out and then allow them to follow through on the best suggestion.
2. Also, go with class to the school cafeteria to weigh the day's waste. Continue this process each day for a week. Develop a class graph to display the data.
3. Allow the class to develop a graph for the county or city's solid waste and recycling data. Discuss trends and develop hypotheses about the future.
4. Brainstorm ways to cut down the amount of cafeteria waste.

What Now?

1. Have the class design a poster for classrooms in the school and the cafeteria encouraging students to reduce the amount of food they throw away in the cafeteria.
2. Write a class Letter to the Editor to make the public aware of your findings and to encourage conservation, reuse, and recycling.

Wonderous Worms!

Grade Level : 4

Subjects:
Science 3.2
Social Studies 5.3, 8.2
Math 4.11
Communication Skills 2.2, 4.2

Time:
at least six months

Setting:
classroom

Materials:
worm box (built by a parent volunteer)
red worms (not earthworms)
dirt
newspapers
water
kitchen scale
kitchen scraps

Skills:
organizing, measuring, observing, record keeping, evaluating, explaining, drawing conclusions

Vocabulary:
decompose
organic waste
inorganic waste
castings

Sources:
Watauga County Recycling Curriculum Committee

Recycling Study Guide
Wisconsin Department of Natural Resources

Summary: Students prepare and observe a classroom worm box.

Objective: Students will be able to explain how red worms assist in the production of nutrient-rich castings.

Background Information: Red worms tolerate temperatures from 40-85 degrees, need a moist environment, need oxygen, cannot tolerate very acidic bedding (add lime to neutralize), have a mouth but no eyes. Castings are the pieces of dirt produced by the red worms. Food wastes should be buried in the bedding to facilitate decomposition by worms and to discourage fruit flies. Food scraps should be fairly small. Extra food can be put in before weekends or week-long vacations, making sure the worms-to-food ratio is observed (1 pound of food every 24 hours for 2 pounds of worms). Stockpile scraps in refrigerator prior to vacation.

Leading Question: How can kitchen waste become a rich soil additive?

Procedure:

1. Hold up a clear plastic bag filled with kitchen scraps and ask what we usually do with these items. Ask if it adds to the solid waste problems we all face today and how. Then suggest that nature has a better way to handle such "organic" waste. Hold up a bag of red worms announcing that these are some of the workers who make it possible. Discuss the preparation of a class worm box.
2. Follow the directions on the next page to complete the task.
3. With suggestions from the class, decide how to get the necessary food, how to put the proper amount in, and how to keep a record of food deposited in the worm box.
4. Organize a quick, easy routine for student helpers to feed the worms each day.
5. Encourage regular observation over time. Have students discuss their findings periodically.

What Now?

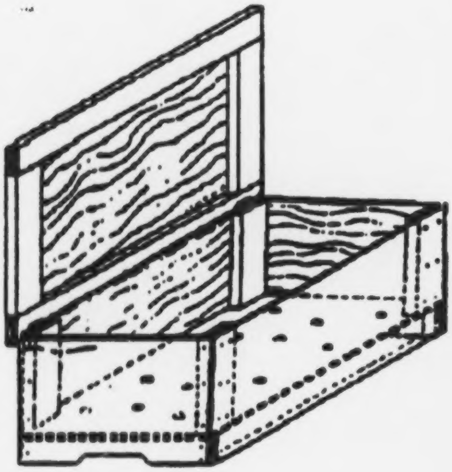
1. Plant seeds in 2 containers. Add castings from the worm box to one container and just regular outdoor soil in the other. Observe, compare, and record plant growth over time.
2. Read Mary Appelhof's *Worms Eat My Garbage*, 1982.

WONDEROUS WORMS!

The Box:
It should be shallow (1' x 2' x 4' to handle 8 lbs. of kitchen waste per week. Don't use treated wood. Use plywood. Drill at least eight holes in the bottom of the box and place it up on bricks so the worms can get some air. The box should be kept in an area where it does not get any colder than 45-50 degrees or any warmer than 85 degrees. (The temperature in the bedding may be different from the air temperature.)

The Bedding:
Two pounds of shredded newspaper (3" x 1/2" strips), warm water, two pounds of red worms, a handful of dirt. (Two pounds of red worms eat 1 pound of food per 24 hours.) (Paper should be as damp as a wrung out sponge.)

The Recipe:
Put the shredded paper in a large, waterproof container. Pour in one gallon of water and stir well. Add the second gallon of water slowly and keep stirring. The paper should be damp. When the paper is well-mixed, put it in your worm box. Add the worms and dirt and spread them over the surface. The worms will work their way down into the paper to avoid the light. Begin to feed them fruit, coffee grounds, crushed egg shells, tea bags, vegetable peelings, crackers, and just about anything else. Bury food wastes to control odor and pests. DO NOT FEED THEM ANIMAL FAT, SKIN, BONES, DAIRY PRODUCTS, OR OILS. Keep the paper damp, but not too wet.



Keep a piece of dark plastic or cardboard over the top of the box - (worms don't like light). If you find the worms are not eating everything you give them, reduce the amount or get more worms.

In six months you should be able to start a new batch by pushing the dirt to one side of the box, putting in new bedding with food on the other side, wait for the worms to enter the new bedding, then remove the dirt and spread the new bedding out. Use some of the castings (the dirt in the worm box) for potting house plants or adding to your garden.

(For more information read WORMS EAT MY GARBAGE by Mary Appelhof).

Nature's Cycle

Grade Level: 4

Subjects:
Science 1.5, 2.1
Social Studies 2.3, 8.2, 9.2, 9.4
Communication Skills 2.2, 4.2

Time:
one hour

Setting:
classroom

Materials:
book, leather shoes, spoon, plastic toy, magazines, scissors, glue, bulletin board with a large tree trunk & branches, sorting cards for each team

Skills:
classifying, observing, evaluating, analyzing

Vocabulary:
resource
renewable
non-renewable
fossil fuels
ceramics
durables
minerals

Sources:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Rethinking Recycling
Oregon Department of Environmental Quality

Summary: After finding out that some products are made from renewable resources and others are made of nonrenewable resources, student teams will sort product cards into their proper resource groups. Then they will cut pictures out of magazines and place them correctly on a resource tree, noting which are renewable and which are non-renewable.

Objective: Students will become aware of how natural resources are used to make everyday products.

Background: Of the four categories of natural resources (mineral/oil, mineral/rock, plants, and animals), only animals and plants can produce more of themselves. These are the "renewable" resources.

Leading Question: Which products are made of renewable resources?

Procedure:

1. Hold up the book, leather shoes, spoon, and plastic toy. Ask what all 4 have in common. (All are made of resources from the earth.) Then discuss the 4 categories (groups) of resources by pointing out the large tree trunk and branches you have mounted on a classroom bulletin board. (See "Resource Tree" illustration.) Develop vocabulary on the tree.

2. Let the class place the 4 items into their four different resource categories. Then ask which of these resources the earth can produce more of (animals, plants). Identify these as "renewable" resources. Review the life cycle of paper's natural resource (a tree) and of a shoe's natural resource (a cow) to illustrate that there is an unending supply of books and shoes if we use these resources wisely. Point out that fossil fuels and minerals are non-renewable resources. Thus, we must use them wisely.

3. Give each team a set of resource sort cards and category cards. Instruct students to place each product card on the correct resource card.

4. Allow teams to cut pictures of various products out of magazines and glue them onto the correct branch of the Resource Tree bulletin board. Classify as renewable or non-renewable as pictures are placed on the tree.

What Now?

1. Pose this question: Which would be better to ask for at the grocery store - a plastic bag or a paper bag? Why?
2. Make posters reminding people to use products made of renewable resources.

coffee mug	tee shirt	sandwich
leather shoes	ruby necklace	newspaper
Styrofoam box	ivory piano keys	dime
coffee	rattle	wool carpet
soup can	paper kite	knobs on a radio
silk necktie	window	tires

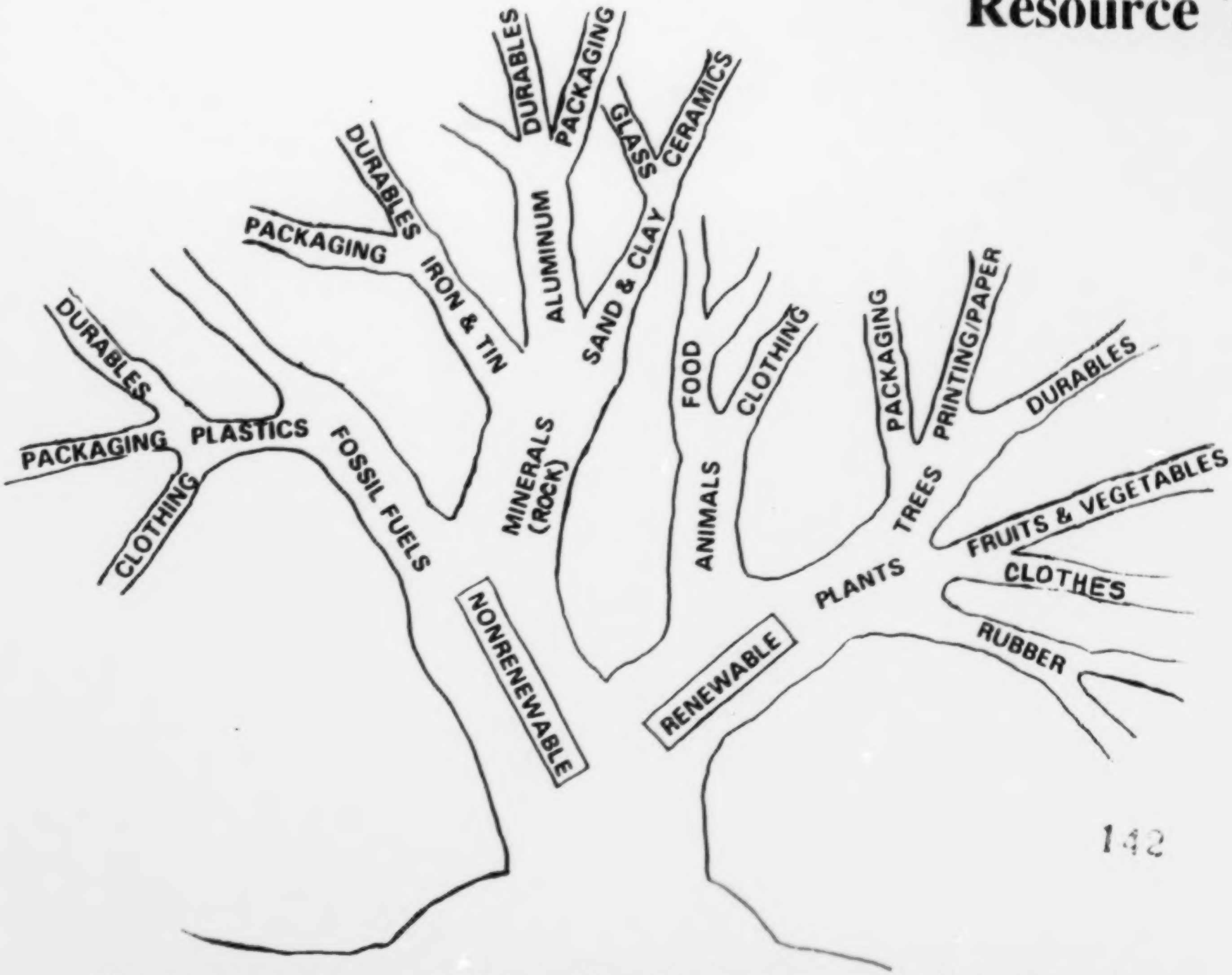
Resourc[illegible]rting Cards - 1 set per team for "Nature's Cycle"

hairdryer	**honey**	**sand**
cardboard box	**hairbrush**	**ice cream**
car	**cotton**	**rayon dress**
feather duster	**aluminum foil**	**bookshelf**

minerals (oil)	**animals**
plants	**minerals (rock)**

For use with Resource Sorting Card for "Nature's Cycle - 1 set per team

Resource Tree


NONRENEWABLE
FOSSIL FUELS
PLASTICS
PACKAGING
CLOTHING
DURABLES
MINERALS (ROCK)
IRON & TIN
PACKAGING
DURABLES
ALUMINUM
DURABLES
PACKAGING
SAND & CLAY
GLASS
CERAMICS
RENEWABLE
ANIMALS
FOOD
CLOTHING
PLANTS
TREES
PACKAGING
PRINTING/PAPER
DURABLES
FRUITS & VEGETABLES
CLOTHES
RUBBER

The earth is the source of everything we make, use and throw away.

This Resource Tree was adapted with permission from the Association of Vermont Recyclers' Teacher's Resource Guide For Solid Waste and Recycling Education, 1988.

PACKAGING

It's A Wrap!

Grade 4

Subjects:
Social Studies 2.3, 5.3, 8.2, 9.2, 9.4
Math 4.8, 4.2
Communication Skills 2.2, 4.2

Time:
one hour

Setting:
classroom

Materials:
a small, inexpensive toy in a large, flashy package; a large can of Hi-C drink and a six-pack of individual Hi-C's with price tags

Skills:
critical thinking, comparison, computation, analysis, evaluation

Vocabulary:
cost-effective
convenience
security
individually wrapped
consumer
producer
renewable
non-renewable
organic

Sources:
Watauga County Recycling Curriculum Committee

Action for a Cleaner Tomorrow
South Carolina Department of Health and Environmental Control

Summary: Discuss why products are packaged as they are. Analyze the impact a certain package might have on the consumer. Investigate how packaging impacts the price of the product.

Objective: Students will find out about various purposes of packaging and will be able to recognize wasteful packaging.

Background: Much of today's packaging is unnecessary. Often it is used to make the product seem better than it is or to show up better on the shelf. With other products, packaging for convenience or ease of use is the case. Safety or protection against theft can be other reasons for special packaging. Ten to 75% of a product's cost is for packaging. Is all that packaging necessary and/or cost-effective? You may want to refer to the "Products and Packaging" sheet for further information.

Leading Question: Why do producers package products the way they do?

Procedure:

1. Hold up a small, inexpensive toy that is in a large fancy package. Ask the leading question: "Why did the producer of this toy decide to package it this way?" Allow for free flow of ideas as you add other thought-provoking questions such as: How many different reasons for packaging can you think of? How do consumers react to different types of packaging? Is more packaging necessarily better packaging? Can you think of products that are over-packaged? What would examples of wise packaging be like? What kinds of materials would they be made of? Why? How does packaging affect the price of a product?

2. To find out how packaging affects price, hold up one large can of Hi-C and ask a recorder to write on the board the number of ounces and the price. The class computes how much 1 oz. of Hi-C would cost. Then hold up the 6-pack of Hi-C and ask the reason behind this packaging (single serving which is easy to transport without leaks or spills). Recorder writes the total number of ounces and the price. When the class computes the cost per ounce, compare this amount to the previous cost per ounce. Discuss why there is such a difference. (You could use other products that come in both single-serving and multiple-serving packages, if you wish.)

It's A Wrap!
(continued)

Procedure: (continued)

3. Take the analysis one step further by asking what the 2 different Hi-C packages are made of. Are they recyclable? Which has more packaging? Where will each finally end up? So which is best? (Point out that some communities do have drink box recycling.)

4. Homework: Find 3 wise packages at home and 3 unwise packages. Be prepared to describe them and tell why you chose each one.

What Now?

1. Create a packaging survey sheet for your class (see sample attached). Take a field trip to a grocery store and complete a survey sheet.

2. Write letters to parents asking them to be aware of wasteful, excess packaging. Explain why it is important to think about it and do something about it.

3. Take a field trip to the grocery store in search of a wide array of potato products. Compute and compare prices per ounce. (Could use corn products or bean products) (see sample attached)

4. Locate the nearest drink box recycling site to your location. Contact the Aseptic Packaging Council at 904-562-8060 for information.

Products & Packaging

Product	Renewable	Recyclable	Nonrenewable	Resource	Is this product necessary?	Is it available in more than one form of packaging?	Which is best in terms of recycling & waste reduction?	Is there an alternative to this product?	How could the packaging be improved to save resources & energy?	What happens to the packaging when the contents are used?	Will this product's packaging become part of NC's waste stream?
	Organic (from living organisms)	Recyclable Packaging	Nonrenewable Recyclable Packaging	Nonrenewable Nonrecyclable Packaging							
Variety pack, snack-sized Potato Chips	Paper-board box	Paper-board box	Metallic	Metallic	Not critical	Yes	Large bags	Other snacks	Wax paper bags, larger bags, reusable tins	Landfilled or incinerated	Yes

WASTE DISPOSAL

Simulated Landfills

Grade Level : 4

Subjects:
Science 3.2
Social Studies 11.1
Math 2.3, 4.3

Time:
one class period for concept development and project
twenty days for observation

Setting:
classroom, outdoor space to put shoeboxes

Materials:
a variety of organic and inorganic waste
2 large cardboard shoeboxes
scissors
1 gallon plastic milk jug
4 garbage bags
10 lbs. soil
watering can with water

Skills:
observation, measurement, comparison, data collection, draw conclusions

Vocabulary:
open dump, landfill
sanitary landfill,
leachate, organic waste
inorganic waste,
biodegradable

Source:
Action for a Cleaner Tomorrow
South Carolina Department of Health and Environmental Control

Summary: Students make a simulated open dump, traditional landfill, and sanitary landfill to observe differences among them and contemplate the affect on the environment.

Objective: Students will discover how landfills work and how they affect their environment. Students will recognize how landfills differ from illegal open dumps.

Background: (See Subtitle D Landfills) Leachate is the liquid that accumulates at the bottom of a pile of waste. It may find its way into the groundwater system.

Leading Question: What is the best method for solid waste disposal?

Procedure:

1. Discuss the new requirements for sanitary landfills and compare them to procedures used prior to the 1980's at open dumps. Ask for student hypotheses about why current specifications are required. (Early procedures for disposing of waste often polluted the environment.)

2. Explain that the class will construct mini-landfills and a mini-open dump in order to observe what happens in each.

3. With all materials before the class, call individuals to come forward and separate the waste items into "organic" and "inorganic" piles. Others make lists of items in the two piles. (Include plastic items, paper scraps, metal items, fabric, food scraps such as fruit peels, newspaper, etc.)

4. Then call on individuals to come up and do the following steps:
   Open Dump: In a large cardboard shoebox, place 3 inches of soil to cover the bottom of the box. Pack it down. Heap in organic and inorganic wastes. Sprinkle with water; label it "Open Dump". Place outside on top of a garbage bag. Every other day sprinkle with 1/2 cup of water. Leave it open to the sun and air. Observe over time.
   Traditional Landfill: In a large cardboard shoebox, place 3 inches of soil all over the bottom of the box. Pack it down. Heap in wastes. Add another layer of soil, another layer of garbage, then top with a layer of soil 3-4 inches deep. Label the box "Early Landfill." Place it in a plastic garbage bag, sprinkle with water and seal with a twist tie. Take it outside where it will remain undisturbed. Every other day open the landfill to sprinkle with 1/2 cup of water. Observe over time.

Simulated Landfills

Sanitary Landfill: Take a gallon-size plastic milk jug and cut out near the top around 3 sides to create a large opening. (The heavy plastic represents the landfill's liner.) Place a heavy garbage bag inside covering the bottom. (This represents another protective layer.) Add 2 inches of soil and pack it down. Heap in organic and inorganic wastes, add another layer of packed soil, another layer of waste, then top with a layer of soil. Seal the cut and top of the jug with heavy duty tape. Because the top is sealed, this will represent a closed landfill, not an operating one. Label it "Sanitary Landfill" and place it in a plastic garbage bag and twist tie it closed. Take it outside. Open it only to observe. Do not water it.

5. Give a Landfill Questionnaire to each student or designated group for discussion or completion.

6. As observations are made over time, write about the findings. Ask open-ended questions such as "What would happen if dangerous chemicals were thrown into an open dump or a landfill?" "What effect would a landfill have on its environment?"

7. At the end, after all observations are complete, teams could do questions 1, 6, and 7 on the Landfill Questionnaire once again to see if their responses have changed.

What Now?

1. Arrange for students to visit a nearby solid waste disposal site.

2. Discuss the advantages of the waste disposal method used there. Are there better methods available?

4.14

LANDFILL QUESTIONNAIRE

1. What 6 words do you associate with a landfill?

______________ ______________ ______________

______________ ______________ ______________

2. Does your city or county have a landfill? If yes, where? If no, where is your city or county's solid waste disposed? ______________________________

____

3. Who selects landfill sites? ______________________________

4. What would you consider to be an ideal site for your garbage? ______________

____

5. If it were determined that our town had an environmentally safe site for a landfill, would you support locating it at the site? Yes________ No________

Why? ______________________________________

6. Do you think landfills have a negative impact on:
(1-strongly agree; 2-agree; 3-disagree; 4-strongly disagree)

Air Quality	_____	Property Values	_____	Aesthetics	_____
Town's Image	_____	Neighborhood	_____	Traffic	_____
Wildlife	_____	Water Quality	_____	Taxes	_____

____

____

____

____

"SUBTITLE D LANDFILL"

Layers of the Landfill

Today's sanitary landfill is engineered to protect public health and the environment.

Subtitle D of the Resource Conservation and Recovery Act establishes standards that municipal landfills must meet. A Subtitle D Landfill is layered like this ↘

Top Cap - The top cap of a landfill must be covered with:

- 2 ft. (61cm) thick soil cover
- Drainage layer
- Flexible membrane layer of 60 mil HDPE plastic*
- 18 inches (45.7 cm) minimum clay liner (1 x 10^{-5} cm/sec max)
- Gas management layer

Bottom Liner - The landfill must have a protective bottom liner system that includes:

- 2 ft. (61cm) protective layer of soil
- Leachate collection system
- Flexible membrane liner (60 mil HDPE plastic*)
- 2 ft. (61cm) clay liner (1 x 10^{-7} cm/sec**)

WASTE DISPOSAL

Classroom Composting

Grade Level : 4

Subjects:
Science 1.1, 2.7, 3.6, 3.7
Math 1.1, 5.1, 6.4

Time:
one class to set up, then observation time

Setting:
classroom

Materials:
small aquarium, organic waste (bread, vegetables, grass clippings, sawdust, wood ash, hair), soil, thermometer, trowel or large kitchen spoon (for turning the compost).

Skills:
observation
measurement
analysis
interpreting data

Vocabulary:
compost
humus

Source:
Recycling Study Guide
Wisconsin Department of Natural Resources

Summary: This activity should follow the "Simulated Landfill" activity (p.4.12). The class will make a small compost pile to compare and contrast with the landfill. The class will make the compost in a small aquarium, and record the temperature inside the compost regularly. At the end of the activity (3-4 weeks), uncover and observe the waste material. IMPORTANT NOTE: DO NOT put any meat, fat, oil, or dairy products into the compost.

Objectives: The student will:
- identify compostable materials
- compare and contrast landfill and compost
- list uses of compost in a household
- read a thermometer
- organize and record data over a 3-4 week period
- construct a line graph showing the temperature of the compost

Background: After observing the environmental problems associated with solid waste disposal in the previous exercise ("Simulated Landfills"), it is important for students to explore alternative methods for reducing, reusing, and recycling these materials. Here, one method of returning organic solid waste back to a usable resource is investigated.

Leading Question: Who has a compost pile?
What is a compost pile?
How is composting different from a landfill?

Procedure:
Wash out the aquarium. Put in a 3 inch layer of soil, then alternate layers of materials (chop the food stuff to speed up the decomposition). Add water between layers. The aquarium should be 2/3-3/4 full when all organic matter is added. Stick the thermometer into the middle of the compost, record the temperature. Place the aquarium in a warm, but not sunny place. Record the temperature at the same location and depth every day. Aerate the pile weekly. Water it enough to keep it moist. A good time to turn the compost is when the temperature has peaked and begins to drop. After 3-4 weeks, carefully sift through the compost, and observe what has happened to the organic material that you began with.

What Now?
1. Use some of the humus to grow plants in your classroom.
2. Set up an experiment to compare growth of plants in the humas as opposed to soil collected outside the classroom. Chart and graph the results.

WASTE DISPOSAL

To The Landfill!

Grade Level : 4

Subjects:
Communication Skills 1.1, 1.2, 2.2, 2.3, 2.4, 3.1, 3.2

Time:
one class period

Setting:
classroom or trip to landfill

Materials:
none

Skills:
questioning
observing
communication

Vocabulary:
will come out as you prepare for the speaker or trip

Source:
Recycling Study Guide
Wisconsin Department of Natural Resources

Summary: This lesson is a guide you can use if: (1) you take a trip to the landfill, (2) you invite a guest speaker.

Objectives: The student will: (1) formulate questions regarding solid waste disposal for your area, and (2) participate in a discussion of solid waste disposal for your area.

Background: Every person in a community should be aware of how the solid waste stream is managed. Unfortunately, few people take the time to acquire this knowledge. Visiting a disposal site or talking with those responsible for managing the solid waste can help the community become better informed.

Leading Question: Where does the trash go from here?

Procedure:
Here are some possible sources for trips and speakers:

- your town/county solid waste management department
- local landfill
- private waste handlers
- local District Health Department - environmental health section
- local soil and water conservation office

Before you visit or host the speaker, compile a list of possible questions. Send the questions to the speaker or guide. They can also lead you toward some research before the trip. Here are some questions to get you started:

- Why is the landfill here (not in another location)?
- When did it open?
- How long will it be open?
- What happens to our trash now? (if it's closed)
- What is the future of waste management here?
- What gets recycled here?
- How much gets recycled here per fiscal year? (July 1 - June 30)
- How much money does the community make on the recyclables?
- What will happen at the landfill in the future?
- How much solid waste comes in here in a day/week etc.?
- Does our city/county operate a transfer station?
- How much does it cost our city/county to operate its solid waste management program?
- How much is the city's/county's budget for schools in that same time period?

What Now?
Divide students into small groups (3-4) and assign a written report from the information they have learned. Allow time for oral presentations of these reports.

WASTE DISPOSAL

Council Counsel

Grade Level : 4

Subjects:
Science 2.6, 4.2
Social Studies 4.2, 5.3, 9.3, 9.4
Communication Skills 2.2, 4.2

Time:
one class period

Setting:
classroom

Materials:
role cards

Skills:
discussion
synthesis
inference
interdependence
evaluation
problem-solving

Vocabulary:
consequences
environmentalist
municipal

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will hold a mock city council meeting to discuss the closing of the local landfill and to make a decision about what will be done with waste in the future.

Objective: Students will evaluate the merits and consequences of various approaches to solid waste management by local governments.

Background: North Carolina Department of Environment, Health and Natural Resources (NCDEHNR) issues landfill permits.

Leading Question: What is the most effective way to dispose of municipal solid waste?

Procedure:

1. Set the stage by telling the class that they are going to have a mock city council meeting. The town must close its landfill because it is full. The council must discuss all its options regarding the disposal of the city's waste. Some citizens are present with ideas to share with the council.

2. Assign a mayor to preside, five council members, six citizens, and a representative. Each character receives a role card to guide what they say. Tell others in class to listen and watch carefully to determine whether or not the council makes the best decision.

3. Let the discussion begin.

What Now?

Invite a local council member or commissioner to speak about this issue in relation to your own community. Find out if your local government has a solid waste advisory committee set up by its elected officials.

MAYOR

Tell the problem and ask the group to share their ideas for possible solutions.

Be sure you let everyone share his or her ideas. Always ask them why they believe their idea is a good one if they forget to tell the group.

After all the ideas have been shared, ask the group to tell the good results and the bad consequences that would come from each idea or solution.

COUNCIL MEMBER #1

You think the city should just haul all the garbage out of town to another landfill 100 miles away. That way the city council won't have to worry about deciding where to put a new landfill of its own.

COUNCIL MEMBER #2

You think the city should burn its trash. That way the city will only have to worry about a little amount of ash instead of lots of trash.

COUNCIL MEMBER #3

You think the city should start a big recycling program and try to get everybody to recycle a lot of their waste. You like the fact that the town can sell the recyclable materials for money that can help pay for getting rid of other waste that can't be recycled.

COUNCIL MEMBER #4

You think the city should just build another landfill. You know about some property over near Lee Smith's farm that would be a good place for it.

COUNCIL MEMBER #5

You want the council to try to talk the state into not closing the landfill. Tell the state that the city just doesn't have enough money to build a new landfill.

CITIZEN SMITH

You strongly disagree with the idea of putting a new landfill near your home. You believe run-off water from the landfill will pollute your drinking water. You also believe that your land will be worth less because no one would want to pay much money to live near a landfill.

TOWNSPERSON #2

You don't like the idea of burning the city's waste because you have read that the smoke from such burning is full of harmful chemicals that will pollute the air in your city.

TOWNSPERSON #3

You agree 100% that the city should start a big recycling program. But you want to warn the city council that even if we set up the best recycling program in the world, we will still have trash to handle also. This is because there are many things that can't be recycled. So the city still needs to figure out what else to do in addition to recycling.

TOWNSPERSON #4

Your concern is that it would be too expensive to haul away all our waste to a landfill 100 miles away. We would have to pay a garbage company to do it or we would have to buy lots of trucks and pay drivers to take the trash to another landfill. It would use a lot of gas to transport all that.

TOWNSPERSON #5

Suggest that the city try to get people who live here to use less, to reuse whatever they can, to not buy things that have too much wrapping, and to put their yard waste, and fruit and vegetable scraps in a compost pile.

NC DEPARTMENT OF ENVIRONMENT, HEALTH, AND NATURAL RESOURCES

You need to introduce yourself to the group because no one in this town knows you. Tell them what agency you work for. You have to let the city council know that state law will not allow the landfill to stay open. If they try to keep it open, they would be breaking North Carolina law and would be fined a large amount of money. Let them know that they may have to raise taxes if they don't have enough money to take care of the problem or find other solutions for disposing of its waste.

N♻C

FIFTH GRADE

TITLE	MAJOR TOPIC	PAGE NO.	SUBJECT AREAS COVERED
My Own Trash	3 R's	5.1	👥 ⚖
What Can We Do?	3 R's	5.2	👥 🎨
School Cafeteria Waste	3 R's	5.3	👥 ⚖
All Day In A Bag	3 R's	5.5	👥 ⚖
What Is Waste?	NATURAL RESOURCES	5.7	💡
How Many Ways Can You Wrap An Apple?	PACKAGING	5.9	👥 🎨
A History of Trash	WASTE DISPOSAL	5.10	👥 🎨
Where Does It Go From Here?	WASTE DISPOSAL	5.12	💡 🧩
Up In Smoke: Burning Trash	WASTE DISPOSAL	5.13	👥 💡
Make A Landfill	WASTE DISPOSAL	5.15	💡
Test Your Knowledge	WASTE DISPOSAL	5.16	👥
Who Says?	WASTE DISPOSAL	5.20	👥 🧩

3 R's

My Own Trash

Grade Level : 5

Subjects:
Communication Skills
1.1, 2.1, 4.1
Math 7.1, 7.10

Time:
one class

Setting:
classroom

Materials:
scale, 39.2 lb. bag of solid waste

Skills:
observe, calculate, develop and write a plan

Vocabulary:
none

Source:
Recycling Study Guide
Wisconsin Department of Natural Resources

Oliver Otter, No Time To Waste
Garbage Disposal Service, Inc. (GDS)

Summary: According to the State of North Carolina, each of us disposes of 5.6 lbs. of trash per day, or 39.2 lbs. per week. In this lesson, the teacher will bring in a trash bag with 39.2 lbs. (one week's worth) of trash in it. Some (or all) of the kids will lift it, guess the weight, and do some simple calculator activities using the 39.2 lb. figure. Then, the kids will write an individual plan for reducing the amount of waste they generate.

Objective: Students will become aware of how much trash they dispose of daily as compared to the average citizen of North Carolina.

Background: Most citizens have no idea of the magnitude of solid waste disposed of by our society. By reducing this portion to an individual and attaching a quantitative measurement to it, the magnitude of the problem becomes much easier to understand.

Leading Question: How much trash do you throw away?

Procedure:

Have the 39.2 lb. bag of trash in front of the room. Ask the leading question, getting estimates from the kids. Pass the trash bag around the class, have the kids lift it. After they have all lifted the bag, ask the kids how much it weighs. After the weight is known, ask the kids why you brought in 39.2 pounds of trash. Have the kids calculate how much trash that the class and their family disposes of each week. Use the memory feature of the calculator to help the kids in their calculations. Find out how much less trash would be disposed of each week if each of us reduced our trash by one pound per day. How much would each of us have to reduce our weekly trash to achieve a 25% reduction of solid waste disposed?

Have each student write a plan for reducing their individual trash disposed by one pound per day incorporating reduce, reuse, and recycle in their plans.

What Now?

1. This activity can lead to an investigation of where the trash goes when it is collected.
2. Find out how much your county or city has reduced its waste stream by calling your local public works or solid waste department or the Division of Pollution Prevention and Environment Assistance at (800) 763-0136 for more information.

What Can We Do?

Grade Level : 5

Subjects:
Communication Skills 1.1, 1.2, 2.1, 2.2, 2.3, 3.2
The Arts 1.3, 2.2, 2.3

Time:
two classes

Setting:
classroom, tour of the school

Materials:
paper and crayons for the posters

Skills:
observing, communicating, analyzing

Vocabulary:
this will depend on what you find, and the plan you come up with

Source:
Watauga County Recycling Curriculum Committee

Summary: These lessons show the students how much solid waste your school generates, and encourages them to think about a class-wide or school-wide program to reduce this amount by reducing, reusing, and recycling. This can be as simple as using both sides of their notebook paper, or as complex as a recycling program for the whole school. What's important is that the kids see that there's an awful lot of trash leaving the school each week, and that there are things they can do to reduce it. You will tour the building, identify a problem, come up with a solution, then make posters to publicize your program.

Objective: The student will:
-define: reduce, reuse, recycle
-observe locations, types, and amounts of solid waste in the school building.
-participate in a discussion of the amount, type, and location of trash in the building.
-contribute to a classroom plan for reducing solid waste in the building.
-plan and produce a poster to publicize the classroom plan.

Background: Tons of solid waste materials leave our schools every day. Too much of this material ends up in a landfill which drains our natural resources and creates problems for the environment.

Leading Question: "Use it up, wear it out, make it do, or do without" Old Vermont Proverb.

Procedure:
Take a walking tour of the building, pointing out where trash is stored, and how much there is. The cafeteria, custodians' trash cans, copier room (to see the copies that didn't make it to the classroom), or anywhere trash accumulates before it is taken out (you may want to scout these sites out ahead). When you get back to class, write the proverb on the board, and ask what it means, and how it could apply to the walk you just took. Go over reduce, reuse, recycle, as they apply to the proverb. Ask the kids if they saw any places in the school where one of these could work. Some ideas are: recycling paper (notebook, copier, computer), drink cans, glass, plastic, food cans from the kitchen, corrugated cardboard, newspaper, etc.; reusing in the classroom, cafeteria, office, and custodial areas. Brainstorm ideas on the board; get the kids to focus on one specific goal; and develop a program to do it. The kids will then make posters publicizing the program.

What Now?
1. You can get other classes in your grade level and the school to join in and expand your project.
2. Find out the cost for picking up and dumping the school's trash.

School Cafeteria Waste

Grade Level : 5

Subjects:
Communication Skills
1.1, 2.1, 2.2, 2.3
Math 1.8, 5.1, 5.2, 5.4,
5.5, 6.1, 6.2, 6.3

Time:
one class to set up, one week to collect

Setting:
classroom, around school

Materials:
none, however, space in the classroom must be allowed for storing the cans and boxes.

Skills:
construct table, line plot/bar graph, summarize, predict

Vocabulary:
corrugated cardboard

Source:
Watauga County Recycling Curriculum Committee

Summary: In order to get an idea of how much waste is generated by the school, the class will collect, record, and graph the number of large tin cans and corrugated boxes used by the school cafeteria in one school week. NOTE: Set this up with the cafeteria in advance. If the cafeteria staff will put the cans and boxes aside so that you or a student(s) can pick them up at your lunch time, it shouldn't be too much problem or inconvenience. The boxes and cans can be recycled at the end of the week, which will let the students see how much is generated, or they can be recycled daily. Each day, the students keep track of how many cans and boxes they have collected. At the end of the week, the students construct bar graphs or line plots showing how much was collected each day, then write a summary of their observations. Ensure that you have proper recycling outlets for materials collected or plan to use your information to help start a program.

Objective: The student will:
-construct a table showing daily collections
-develop a graph showing the daily collections
-write a summary describing daily collections and predict future collections

Background: We tend to see data much more clearly if it is communicated in a chart or graph. The impact of 39.2 lbs. of solid waste disposed of per person per week is just a number until we can get a visual image (the actual trash on a graph) showing us how tremendous the problem is.

Leading Question: How much trash does our school throw away?

Procedure:

Ask the question, then discuss how much waste comes out of the school, what types of waste, and the sources of the waste. Lead the discussion to the cafeteria, and what is generated there. It would be almost impossible for a class to calculate the total waste generated by a whole school. This investigation will focus on two types of waste (both of which are potentially recyclable) from the cafeteria: "tin" food cans and corrugated cardboard.

Collect both for 5 school days. During the first class, have the students set up a table for each day's collection. You can predict the total collection, and each day's collection. After the collection is complete, have the students make a graph (line plot or bar graph) showing the collections for each day. have the students analyze their data (i.e. which day had the most, which had the least, pattern of collections, etc.) and then write a summary of what they observed.

5.4

School Cafeteria Waste (continued)

What Now?

1. This activity can lead to predicting how many "tin" cans and corrugated boxes can be collected for a year. It can also lead to a cafeteria recycling project. The students can weigh the individual cans, and calculate the total for the week, predict for the year. They can do the same for the cardboard.

2. Have students find other items that could be targeted for recycling in the cafeteria. Discuss how food waste, glass jars, plastic containers (mayonaise, mustard, etc.) could be recycled.

All Day In A Bag

Grade Level : 5

Subjects:
Communication Skills1.1, 1.2
Math 1.1, 1.7, 1.8, 4.6, 5.1, 5.5, 5.6, 7.12, 7.13, 7.14

Time:
two class periods

Setting:
classroom, cafeteria

Materials:
grocery size bag for each student, "zip-lock" type bag (1 gal. size) for each student, scales or triple beam balance for each group.

Skills:
measurement, communication

Vocabulary:
none

Source:
Watauga County Recycling Curriculum Committee

Summary: This activity is designed to show the students how much trash they generate in a full school day, in the classroom, in the cafeteria, etc. To do this, they will carry bags with them everywhere they go during the day and put their trash in the bag instead of the trash can. The "zip-lock" bags are for storing food and liquid. The second day, the students will analyze their trash.

Objective: The student will:
-collect and separate waste he/she has generated for 1 school day.
-measure the mass of each type of waste.
-compute group and class totals for the total waste.
-compute average amount of waste generated for the group and for the class.

Background: We are not aware of how much waste we generate everyday.

Leading Question: How much waste do each of us generate here at school?

Procedure:
Ask the leading question and then discuss how to answer it. Each student will get a grocery bag for papers and dry waste and a 1 gallon "zip-lock" bag for food and liquids. The children are to put ALL the waste they generate during the day into one of the two bags. HINT: Practice opening and sealing the "zip-lock" several times to make sure that everyone can close the bags completely. Paper and dry waste go into the grocery bag, food and liquids go into the "zip-lock" bag. You've probably figured out by now that this can be a messy activity if the "zip-lock" bags aren't sealed properly. You could leave out the liquid waste if you think this could be a problem.

The students will save their waste for the day. Then the next day they will separate it into categories and weigh each category. If working in groups, they can compute group and class averages for the categories and for total waste.

What Now?
1. Have students calculate the amount of solid waste disposed of by the entire school in a day, week, month, and year.

FOOD

TYPE	WEIGHT

TOTAL FOOD: ____________________

NON-FOOD

MATERIAL	CHECK ONE		WEIGHT
	RENEWABLE	NON-RENEWABLE	

TOTAL RENEWABLE: ____________________

TOTAL NON-RENEWABLE: ____________________

TOTAL WASTE: ____________________

What Is Waste?

Grade Level : 5

Subject:
Science 2.3, 2.5, 2.9, 4.2

Time:
one class

Setting:
classroom

Materials:
a piece of candy for each student, placed on their desk, chalkboard/chart paper for recording student ideas.

Skills:
classification, communication

Vocabulary:
waste

Source:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Summary: Students eat candy (individually wrapped: hard candies, chocolates, etc.) as you begin a discussion of waste. Later, they will realize that the wrapper of their candy is waste, which must be properly disposed. You will define "waste," listing several specific kinds of waste, and then the students will divide those kinds of solid waste into categories.

Objectives: The student will:
-define "solid waste"
-name different, specific kinds of waste
-categorize specific kinds of solid waste into broader categories

Background: People take waste for granted and they are not aware of the effects or the amount of waste created by packaging.

Leading Question: What is solid waste?

Procedure:

Begin by passing out the candy, let the students eat it. Ask the leading question, write the students' answers on the board or chart paper. Remember that everything will, in time, become waste: cars, the building you're in, the school buses, etc. Waste also comes in many forms- paper, metal, air, water, etc. At some point, the students will find that they have to do something with their candy wrapper; it has become waste. Some may throw it in their desks, on the floor, leave it on their desks, or get up to throw it in the trash. Make note of the individual responses to their "solid waste disposal problem;" you can discuss them later, at the end of the lesson.

When you have a long list of different forms of waste, break the class into small groups (3 or 4). Ask each group to break the big list of waste into categories according to criteria on which each group member can agree. Bring the whole group back together and share the larger categories of waste, as well as the individual types of waste they put into each category. Ask each group into which category their candy wrapper would best fit.

What Now?

1. Discuss types of waste at school, home.
2. Investigate where the solid waste goes and what happens to it when it leaves the class.

What Is Waste (continued)

Mass Before Lunch: **SCHOOL LUNCH WASTE** **Mass After Lunch:**

ITEM	FOOD	NON-FOOD		
		made of	renewable	nonrenewable
sample:				

1. Which category has the most waste? ____________________

2. Which has the least? ____________________

3. Which types of waste were reusable? ____________________

____

4. Which types of waste were recyclable? ____________________

____

5. What can we change to reduce our lunch waste? ____________________

____

____

PACKAGING

How Many Ways Can You Wrap An Apple?

Grade Level : 5

Subjects:
Communication Skills
1.1, 2.1, 2.2, 2.3
The Arts 1.1, 2.1, 2.2

Time:
two to four days

Setting:
classroom

Materials:
an apple for each group, paper, glue, assorted decorating stuff: buttons, glitter, ribbon, etc., posterboard, video camera, tape recorder and cassettes, paint, crayons, etc.

Skills:
communicating, designing, critical thinking, problem solving, analyzing

Vocabulary:
packaging

Source:
Recycling Study Guide
Wisconsin Department of Natural Resources

Summary: Each group of 3 or 4 students is a team whose job is to package and sell apples. They want to make the most attractive and enticing product on the market today. First, the teams will develop a package for their apple. As they develop the package, they keep track of their ideas, and why they chose the package they did. Second, the teams plan a sales pitch for their apple. These can be: commercials (either live or on video), songs, posters, poems, jingles, or whatever they think will sell the most apples.

Objective: The student will:
-participate in a group project to package and sell the product.
-justify and explain why certain ideas were accepted by the group and other ideas were rejected.
-develop original ideas for packaging and selling the apple.
-produce original art with the purpose of promoting the apple.

Background: We often buy products with no consideration given to how the packaging adds to the cost of the product and with little thought given to how the packaging adds to the solid waste problem.

Leading Question: Who wants to buy my apple?

Procedure:
Before you begin, arrange with another teacher to have their class be your "consumers." Show the class two apples, one unwrapped, and another in some sort of package. Ask the leading question. Break them into teams of 3 or 4. Give them their sales assignment and a deadline for presentation.

In your class, ask the question: "What was the difference in your products?" Packaging and sales pitch were different - the product itself was identical. Who pays for the packaging and sales? What happens to the package? Compare how long the package will last compared to the product inside. Draw parallels with products they may use: drink boxes, plastic juice bottles and food cups, etc. Does the package change the product, or is fruit drink or pudding the same no matter what the package might be? Does the packaging positively or negatively impact the life of your product (apple)?

What Now?

1. The class can take a more formal or in depth look at packages and evaluate packages the kids commonly use.

5.10

WASTE DISPOSAL

A History of Trash

Grade Level : 5

Subjects:
Communication Skills 1.1, 1.2, 2.1, 3.1
The Arts 1.1, 1.2, 2.1, 2.2, 3.1

Time:
one class

Setting:
classroom

Materials:
"History of Trash" handout, paper, crayons, rulers

Skills:
communication, analyzation

Vocabulary:
incinerator
dump
organic

Source:
Oliver Otter No. 1: No Time to Waste
Garbage Disposal Service, Inc. (GDS)

Summary: The students will read a short history of trash, from which they will pull several important dates. Then, they will develop an illustrated time line of trash.

Objective: The student will:
-read silently "A History of Trash"
-list, in chronological order, significant events from the reading.
-draw and illustrate a time line depicting the significant events from the reading.

Background: (See attached "A History of Trash")

Leading Question: How long has trash been around? How long has it been a problem?

Procedure:
Hand out "A History of Trash," have the children read it silently. After they have finished, they list the major events, along with the year they occurred. With the list they have made, they will draw a "Timeline of Trash Through the Ages." They can illustrate their timeline with pictures that go along with the events.

What Now?

1. Obtain the solid waste records for the last 10 years in your city or county from your local solid waste management office. Compare the amount and methods of disposal with early practices you read about in "A History of Trash."

2. Discuss ways to reverse the trend toward reduction, reuse, and recycling.

5.11

A HISTORY OF TRASH

In the early days, trash wasn't a problem because people traveled in tribes, probably following the animals they hunted. Trash was dumped along the way, so that it was spread out over a large area. In those days, there were not many people to throw their trash away.

By the time Fred and Wilma Flintstone settled in Bedrock however, trash did become a problem because people had settled down in towns and no longer spread their trash out.

The Romans opened the first trash dump in 500 BC because people were throwing their trash out of the window, into the street. Not only did a lot of people slip on banana peels and get hurt, but the rotting garbage was unsanitary and caused disease. The Romans made people carry their trash a mile out of the city to the dump.

Over the years, people got tired of walking to the dump and back and simply threw their trash into ditches. So, a lot of people slipped on banana peels when they walked in the ditches. Even more people got sick because of the nasty conditions, not to mention that the dumps smelled really bad!

In 1388, the English parliament had smelled enough, and they passed a law forbidding the dumping of trash into ditches. By 1400 in Paris, the piles of trash outside the walls of the city got so high that the soldiers couldn't defend the city against invaders. The piles of garbage were too high to shoot over!

In the United States, trash was first incinerated in 1885. New York City began burning its trash because they had run out of room to dump it. By 1912, 75% of American cities had some form of garbage collection. The other 25% probably smelled horrible!

People along the coasts of America loaded their trash into boats, sailed out into the ocean, and dumped it overboard. So a lot of fish probably slipped on banana peels, in the stinky water. In 1933, ocean dumping was outlawed.

The first major recycling program in the United States began in 1945. Paper and aluminum were recycled to help with World War II.

After World War II, people began to shop more and more in supermarkets. There, for the first time, they could buy products in smaller packages of glass and cardboard. All that packaging ended up in landfills. The peak of glass and cardboard packaging waste came in 1954.

By the 1960's, glass and cardboard were beginning to be replaced by plastic, which was lighter and stronger than glass and cardboard. By the late 1960's, people became aware that landfills were getting full, and that more attention needed to be paid to how much trash we put into the ground.

In 1970, we celebrated the first Earth Day, which tried to make us all aware that our planet was getting full of trash and pollution. What is our town/county/school doing for Earth Day? In 1993, each American generated 1,200 pounds of trash per year (the weight of a small car). In 1993-94, North Carolinians disposed of an average of 5.6 lbs. per person per day.

WASTE DISPOSAL

Where Does It Go From Here?

Grade Level : 5

Subjects:
Science 3.2, 1.4, 2.4
Social Studies 11.1

Time:
two classes

Setting:
classroom

Materials:
crayons and paper for maps

Skills:
communications, formulating models

Vocabulary:
dump
landfill
sanitary landfill

Source:
Watauga County Recycling Curriculum Committee

Summary: This activity traces the path of waste after it leaves the classroom to the landfill. It defines and describes what a landfill is, and how it is different from a trash dump. The lesson also asks what happens when any part of the path from classroom to landfill is unavailable.

Objective: The student will:
-plan and draw and illustrate a map showing the path of trash from class room to landfill.
-compare and contrast trash dump and landfill.
-write a paper describing a possible solution for the absence of local landfill in which to dump trash.

Background: In order to appreciate a clean environment, it is necessary to realize that many steps are involved in waste disposal.

Leading Question: What happens to the trash after it leaves the classroom?

Procedure:
Day One - Ask the leading question and then get response from class. Be sure to include: dumpster, trash truck, landfill. Ask why we don't just dump the trash out in the woods. List the problems: smell, disease, danger from glass, nails, poison, etc., in the trash; messy; ruin the woods; trash would end up everywhere; water pollution; etc. Describe landfills, how they are alike/different from dumps. Have the kids draw and illustrate the path from the classroom to the landfill.

Day Two - Review the path that you established on Day 1. Then ask "What would happen if we didn't have one part of the path?" Take out: the dumpster, the trash truck, and the landfill, one at a time, and have the kids brainstorm possible solutions.

What Now?
This lesson can lead to a trip to the landfill. For some ideas about a trip to the landfill, see "To The Landfill!" page 4.17.

WASTE DISPOSAL

Up In Smoke: Burning Trash

Grade Level : 5

Subjects:
Communication Skills
1.2, 2.2, 3.3
Science 2.1, 2.2, 2.6, 2.7,
2.9

Time:
one class

Setting:
cafeteria, outside

Materials:
an outside space close enough to run a hose and large enough to put out the fire bucket **AT LEAST 50** feet from buildings, cars, dumpsters, or anything that could ignite; a metal bucket to serve as the incinerator, trash, as described above (you'll want enough paper and cardboard to keep the fire burning); matches; a hose hooked up and ready to put the fire out; each kid will need a notebook and pencil

Skills:
communicating, observing, classifying, inferring, predicting, interpreting data

Vocabulary:
incinerator

Source:
Watauga County
Recycling Curriculum
Committee

Summary: This lesson should come after "Make a Landfill"(page 5.15), so that you can compare incineration with landfills. In this lesson, you will demonstrate incineration by burning a sample of trash. This can be a very tricky lesson, for obvious reasons. You may want to consider using it because incineration is one of the methods being used to dispose of solid waste. In 1994, almost 10% of the solid waste in the U.S. was burned. Solid waste incineration is a much more technical process, using sophisticated equipment and there are limited ways to show this in a classroom. For safety this activity is designed to prevent students from coming into contact with burning materials. You also need to choose what you'll burn very carefully. Typical solid waste items such as paper, cardboard, cans, food, glass bottles are good for this activity. **ABSOLUTELY AVOID**: aerosol cans (they explode), any plastics (they can give off toxic smoke), flammable material or anything you're not sure about. Even with these restrictions, you can get enough trash together, and burn it in a safe way.

Objective: The student will:
-give examples of methods of waste disposal other than burial in a landfill.
-define incineration
-compare and contrast landfill and incineration as waste disposal techniques.
-make written observations of incineration of trash.
-write a written summary of their observations of the burning trash.

Background: Although incineration as a disposal method has a negative connotation today, it can still be a viable option if materials for incineration are selected carefully. With specific attention paid to materials burned, smoke stacks and ash treatment incinerators may become necessary as landfill space disappears.

Leading Question: Other than burying trash in landfills, what can we do with it?

Procedure: Have the site for the demonstration set up in advance, with the hose connected. Ask the question and have the students brainstorm answers. Hopefully, burning will be suggested as a method of disposing of solid waste. Either brainstorm with the class or in groups the positive and negative effects of incineration. As a class, think of solutions for the negative effects of burning trash. Direct students to trash burning area and ask them to: 1. Observe the fire, and write observations as it burns, 2. When the fire is out, look at the remains; (what has burned and what has not), 3. Using their notes and observations of the fire, the students write a paper comparing landfills and incineration. **IMPORTANT POINT**: Tell the kids that incinerators are specially designed equipment, and that the burning takes place in a closed container at a much higher temperature. Smoke from an incinerator is not as thick as what they have seen, although it is a concern in the incineration process as well as the resulting ash. Glass bottles and metal cans will not break down in this activity as they will in an incinerator.

What Now?

1. NC has incinerators in New Hanover County and Mecklenburg County and others are scheduled to open in Fayetteville and Kinston. You can write to them with questions or for information. Contact the Solid Waste Section for information on permitted facilities (919) 733-0692.

WASTE DISPOSAL

Make A Landfill

Grade Level : 5

Subject:
Science 1.3, 2.1, 2.6, 2.11

Time:
one class, then observe

Setting:
classroom

Materials:
3 kinds of trash: Food (see summary for note), recyclable (aluminum, glass), and nonfood, non-recyclable (sandwich bag, plastic, etc.) 3 quart size jars, soil, crayons, and masking tape (for marking jars)

Vocabulary:
biodegradable
decompose
non-biodegradable

Source:
Recycling Study Guide
Wisconsin Department of Natural Resources

Summary: In this lesson, the class will make a (very) small landfill, using small (quart) jars. A good source for the trash would be lunch trash from your students. IMPORTANT NOTE: **DO NOT** try this with: meat, cheese, or fats. Some organics like fruit, bread, cookies, etc., work well. Don't forget to get some non-degradable trash, too. You will need 3 types of trash: organic (foods that decompose), recyclable, and non-recyclable.

Objectives: The student will:
-define and give examples of biodegradable and non-degradable items.
-compare and contrast degradable and non-biodegradable items.
-observe the changes in the three containers.

Background: Landfills are not designed to promote decomposition of biodegradable materials. Water, light, and air, major components necessary for decomposition to take place, are excluded from the landfill environment to the extent possible.

Leading Question: What happens under the ground at a landfill?

Procedure:
Ask the question, then get the students's ideas about how a landfill works. Ask how they could prove it. Get some trash from lunch. Put 1-2 inches of soil into each jar, then the trash. Bury the trash with soil and then label each jar. Keep the soil moist in the jars, store them. Once or twice a week, look at each jar, and record the changes. NOTE: Brainstorm reasons why decomposition does not always occur in a landfill. Researchers have excavated landfills after years of being buried, and have found whole hot dogs and 35 year old newspapers that were readable.

What Now?

1. This can lead to a discussion of what we should keep out of landfills and of how much goes into landfills that is recyclable and shouldn't be there.

WASTE DISPOSAL

Test Your Knowledge

Grade Level : 5

Subject:
Communication Skills
1.1, 2.6, 2.7, 3.5

Time:
one class period

Setting:
classroom

Materials:
handout with quiz

Skills:
communicating, interpretation, application

Vocabulary:
biodegradable

Sources:
Watauga County
Recycling
Curriculum Committee

Oliver Otter, No Time To Waste
Garbage Disposal Service, Inc. (GDS)

Summary: This can be used as a pretest, post-test, or both. It brings out several national and local solid waste issues.

Objective: The student will:
-choose the correct answer from among those given for each item.
-give reasons for choosing the answer chosen.

Background: Citizen awareness of the kind of waste management program being carried out by a community is crucial for the success of the program. Many people simply don't know what can be done to help preserve our resources. It is part of our responsibility as educators to find out what our students know about local programs and help them to become aware of how they as students can get involved.

Leading Question: For Pre-Test, "Let's see how much you know about solid waste before we begin to really look at it."

Procedure: Hand students the quiz, let them complete it, then go over the answers. This activity can lead to discussion about the topics, to further research, or further study.

What Now?
After completion of your discussion, research, and study, retest students using the same test and compare the Pre-Test to Post-Test scores.

Test Your Knowledge (Continued)

QUIZ

Circle all answer choices that are correct:

1. On average, each man, woman, and child in North Carolina disposes of ??? pounds of solid waste per day?
   - A. 16.4
   - B. 1.27
   - C. 10.00
   - D. 5.6

2. What is North Carolina's waste reduction rate?
   - A. 5.69%
   - B. 10%
   - C. 1%
   - D. 70%

3. Each year, the US produces ??? pounds of solid waste?
   - A. 300,000
   - B. 3,000,000
   - C. 3,000,000,000,000
   - D. 30,000,000

4. Which of these can be recycled in our town/county?
   - A. Glass
   - B. Flashlight Batteries
   - C. Aluminum Cans
   - D. Milk Jugs (HDPE #2)

5. Which of these are biodegradable?
   - A. Paper Bags
   - B. Glass Bottles
   - C. Aluminum Cans
   - D. Cardboard

6. Which of these solid waste management programs does our town/county sponsor?
   - A. operates landfill
   - B. old appliances are collected
   - C. trash gets pressed into bales before disposal
   - D. Glass is collected for recycling

7. Composting turns solid waste into:
   - A. new plastic bottles
   - B. newspaper
   - C. water
   - D. humus

Test Your Knowledge (Continued)

8. Why do plastics have different recycling numbers?
    - A. The higher the number, the more it's worth
    - B. Only odd numbers can be recycled
    - C. Some plastics are made of different chemical resins
    - D. Different colors have different numbers

9. Which of these are recommended for composting in a backyard compost pile?
    - A. Hamburgers
    - B. Apples
    - C. Butter
    - D. Bread

10. List everything you know that you as a citizen can do to help protect our natural resources.

Test Your Knowledge (Continued)

QUIZ KEY

1. D
2. A
3. C
4. Answers will vary
5. A, D
6. Answers will vary
7. D
8. C
9. B, D
10. Answers will vary

Who Says?

Grade Level : 5

Subjects:
Communication Skills
1.1, 1.2, 1.3, 2.1, 2.2, 3.3, 4.2
Social Studies: 2.3, 5.3

Time:
two classes

Setting:
classroom

Materials:
paper, pencil

Skills:
questioning, application of knowledge, critical analysis

Vocabulary:
will be determined by the problem identified

Source:
Watauga County Recycling Curriculum Committee

Summary: The class identifies a local solid waste issue or problem. Individual students write letters to highlight the issue or problem and suggest solutions. A letter or letters are then sent to local or state government officials or local elected officials.

Objective: Students will become aware of their responsibility as citizens to inform government representatives of their desire on environmental issues.

Background: The best way to insure that the desires of citizens are considered in environmental issues is to stay in touch with decision-makers and inform them of your position.

Leading Question: Review what the class has done. Ask what could be done and why it isn't.

Procedure:

You may have an issue in mind before, or you can brainstorm.

Samples - Why isn't ________________ recycled?
-How can we help save money?
-Where does ________________ happen?
-Review business letters - go through writing process.

How much revenue does your community receive for its recyclables?

What do other communities do for recycling?

Are these items recycled in our community? If no, why not?
-polystyrene #6, #3, #4, #5 plastic
-Colored #1 PET and #2 HDPE plastic
-Drink boxes (aseptic packaging)
-Chipboard (cereal boxes)

What will happen to the landfill in the future?

What Now?

1. You can have each student choose a topic, do research, and send a letter. You could instead have all students write about the same topic and choose one letter to send.

SIXTH GRADE

TITLE	MAJOR TOPIC	PAGE NO.	SUBJECT AREAS COVERED
From The Cradle To The Grave	3 R's	6.1	💡 👥
Now Hear This	3 R's	6.2	💡 👥
Recycling Organic Matter Into Usable Compost	3 R's	6.4	💡 ⚖
Eco-Label Project	NATURAL RESOURCES	6.7	💡
Planned Obsolescence - What Can We Do About It?	NATURAL RESOURCES	6.10	💡
Less Power Equals Less Waste	NATURAL RESOURCES	6.11	💡
Are You An Impulse Buyer?	PACKAGING	6.13	💡
Don't Throw That Away!	PACKAGING	6.15	💡 🎨 👥
The Case Of The Missing Trash Can	WASTE DISPOSAL	6.17	💡 ⚖
Disposal of Large Appliances	WASTE DISPOSAL	6.19	💡 👥
How Much Of Our Lunch Becomes Waste?	WASTE DISPOSAL	6.21	💡 ⚖
Get A New Landfill?	WASTE DISPOSAL	6.23	💡

From The Cradle To The Grave

Grade Level : 6

Subjects:
Science 4.2, 5.1, 5.2
Communication Skills 1.0, 2.0

Time:
two to four class periods

Setting:
classroom, media center

Materials:
research materials such as encyclopedias, CD-Rom, books, magazines, Internet access (if available)

Skills:
analyzing, interpreting

Vocabulary:
biodegradable
photodegradable
raw materials
processing

Source:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Summary: Students working in groups of 5-6 will research a packaging product to determine its over-all environmental impact. Information gathered will be shared creatively in skits, plays, raps , etc.

Objective: Students will understand the total impact of a product, from raw materials to disposal.

Background: Some packaging materials have "hidden environmental costs." Examples are the mining of bauxite for aluminium, the bleaching of wood pulp for paper, disposal cost, transportation cost, etc. All these have environmental consequences sometimes overlooked when evaluating packaging.

Leading Question: When you recycle an aluminum can, do you know how much energy was involved in producing the aluminum? Do trees create "white paper"?

Procedure:

1. Assign each group one of the following materials to research:
   a) aluminum,
   b) plastic bottle
   c) cardboard
   d) mixed metal (food can)
   (e) glass bottle
   (f) waxed paper
   (g) polystryrene
   (h) aseptic package
   (List can be extended)
2. Each group will research their product from beginning to end. (cradle to grave)
3. Students will write and perform skits, play, raps to illustrate information gathered.
4. Evaluate each packaging product as low, medium, or high as to environmental impact.

What Now?

1. What packaging materials are not worth the price?
2. Can we, as consumers, reduce the impact of certain materials used in packaging?
3. Write letters or e-mail to companies that use "high environmental impact" packaging asking them to reconsider the choice for packaging their product. Search the Internet for trade associations to find out new technologies that are less polluting. Write letters of appreciation (or e-mail) for environmental concerns.

Now Hear This

Grade Level : 6

Subjects:
Science 4.1, 4.2, 4.3, 4.4, 5.1
Communication Skills 1.0

Time:
two or three class periods

Setting:
classroom, TV room, intercom system

Materials:
video camera, video tape, TV, intercom system, props

Skills:
communication, listening, analyzing, observe

Vocabulary:
PSA-public service announcement
ozone safe
aseptic packaging

Source:
A-Way With Waste
Washington State Department of Ecology

Summary: Students will write and perform commercials with an environmental message. These messages will be video taped and/or audio taped and shared by way of close circuit TV and/or intercom.

Objective: Students will learn that commercials can be used to promote an environmental message.

Background: Many products that are desirable to the consumer have an adverse impact on the environment. These effects may not normally be considered by advertisers or purchasers. With increased concern and emphasis on the environment, advertisers are adding more and more environmental messages to their ads.

Leading Question: How many advertisements do you see that mention the environment?

Procedure:

1. Notify students that they are to look for locally advertised products that contain an environmental message. These ads can be TV, radio, or newspaper and magazine ads.
2. Have students discuss five advertisements in detail, explaining how the advertisements suggest positive environmental impacts.
3. Allow students, working in teams of 3-4, to write their commercials containing an environmental message.
4. Video tape or audio tape student advertisements as they are presented.
5. Share these messages with the rest of the school through close-circuit TV or intercom.

Examples:

1. Find out who accepts used motor oil in your county/city.
2. Find out if newspapers in your county/city use any recycled newsprint.
3. Promote juice in aluminum cans instead of aseptic boxes if not recycled in your area.
4. Find out which grocery stores recycle cardboard and grocery bags or offer a rebate if you bring your own shopping bag.
5. Find out what car manufactures use ozone-safe air conditioner coolant and promote car part recycling.
6. Find out which restaurants recycle food cans, glass, aluminum or

Now Hear This (continued)

other items.

What Now?

1. Should we carefully consider the environmental impact of a product before purchase?

2. Can consumers demand products that are safe for the environment?

3. Share advertisements at Parent meetings, teachers' meetings, PTA, etc.

4. Consult local radio station, newspaper, TV station, for a PSA announcement of appropriate ads.

5. Review the Federal Trade Commission's (FTC) guidelines for environmental labeling. (See appendix)

3 R's

Recycling Organic Matter Into Usable Compost

Grade Level : 6

Subjects:
Science 2.1, 2.6, 2.7,4.1, 4.2, 5.1
Math 6.1, 6.3

Time:
one or two class periods to set up - observations will be continuous.

Setting:
classroom and outside class area

Materials:
two 3-liter plastic bottles, sharp needle for poking holes, tools for cutting plastic bottles (exacto-knives work well and can usually be borrowed from the art teacher), netting or mesh fabric, rubber bands, organic material for composting (use materials collected from activity "How Much of Your Lunch Becomes Waste?" - (page 6.21) be sure to add leaves, shredded paper and grass clippings, pans or buckets with 6-8 liter capacity for mixing of materials, large spoons or paint stirrers, thermometers

Skills:
observing, interpreting data, experimenting, manipulative

Vocabulary:
organic, composting

Source:
Adapted from "*Garbology*"

Summary: Cooperative groups of 3-4 students will create compost in a three-liter, clear soda bottle. Observations will be continuous throughout fall and winter. In the spring, students will use compost as fertilizer for gardens or indoor plants.

Objective: Students will learn that organic matter can be recycled into a nutrient base for plant growth.

Background: Composting is the natural process of decomposition. When people compost, they encourage the natural process of rotting and the result is a dark, earthy-smelling, crumbly material that is an excellent soil conditioner. Composting returns organic material to the earth, recycling it for other forms of life. By not composting, we lose in two ways. Number one, we lose valuable nutrients that could help retain top soil. Number two, if we put compostable materials into the trash, we must pay to have these trucked away for disposal.

Leading Question: How can we recycle the organic material found in your lunch waste into nutrients for new plant life?

Procedure:

1. Assist each cooperative group in creating a compost column from soda bottles. (See illustrations attached).
2. Collect all left-over organic lunch waste excluding all meat and dairy products; add grass clippings, shredded paper etc., into mixing containers and stir thoroughly.
3. Add enough water to moisten (1/2-1 liter).
4. Place mixture into the compost column.
5. Instruct each student to record ingredients added to their column into their notebooks.
6. Instruct students to create a table for collecting data on their column.
   Sample data page
      Date:
      Compost temperature:
      Room temperature:
      Odor:
      Color:

Observations: (Some students may want to focus on their own contributions such a banana peel, egg shell, etc., and record changes that occur.)

7. Observe and record data at least once a week for two months.
8. Observe and record changes monthly until spring.
9. Pour contents from column into pans and notice changes.

6.5

Recycling Organic Matter Into Usable Compost (continued)

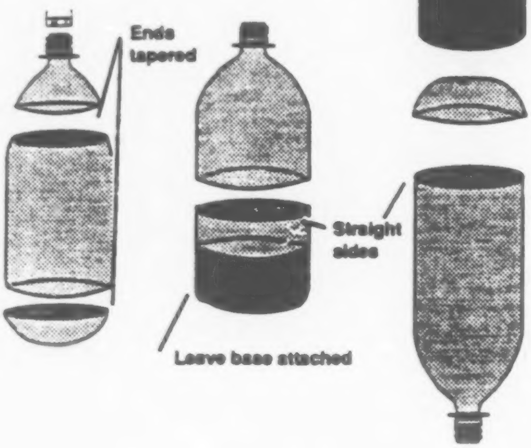
10. Encourage students to pick up handfuls of results and smell.
11. Mix resulting compost into soil that has been prepared for planting.

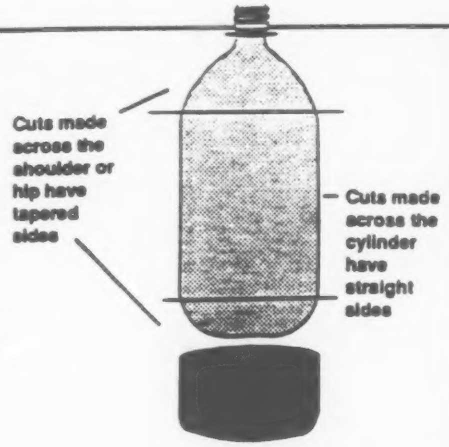
*If odor becomes offensive, move outdoors into a secure area.

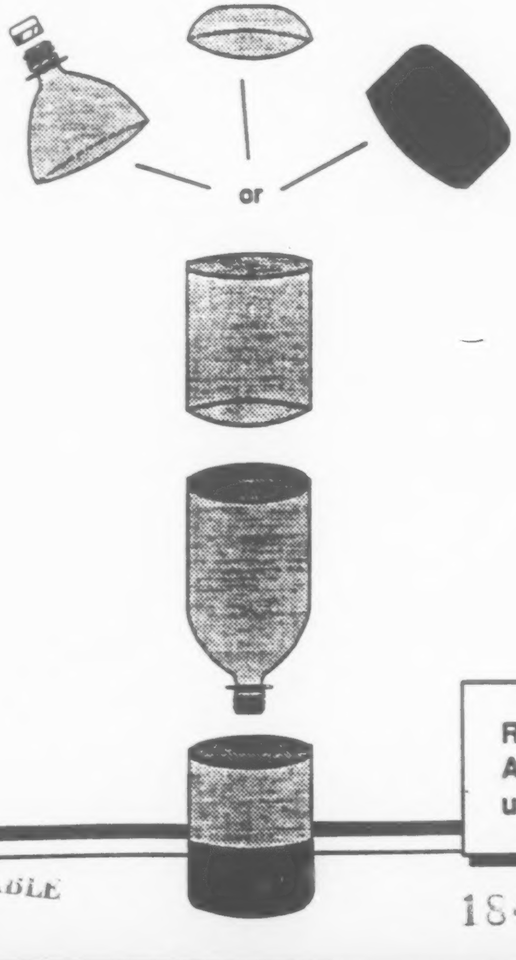
What Now?

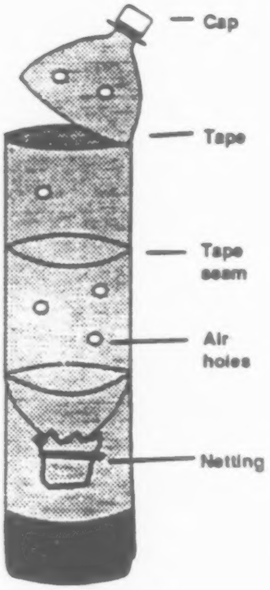
1. Are we throwing money away by not composting organic matter? Explain.
2. Should citizens be required to separate certain compostable materials from their trash? Explain.
3. Share compost column ideas with lower grades.
4. Begin a compost pile or compost column at home.
5. Make graphs of data collected.
6. Display data using spreadsheet.

Compost Column (2-bottle version)


Ends tapered
Straight sides
Leave base attached


Cuts made across the shoulder or hip have tapered sides
Cuts made across the cylinder have straight sides




Cap
Tape
Tape seam
Air holes
Netting

Recycle!
All column components and unused parts are recyclable.

Eco-Label Project

Grade Level : 6

Subject:
Science 2.6, 5.1

Time:
one class period and homework

Setting:
classroom, media center

Materials:
art supplies, magazines, books, newspapers published after 1990, copy of " Eco-labling in the European Community" for each group.

Skills:
interpreting, analyzing

Vocabulary:
eco-label

Source:
Health Harvest Magazine

Summary: Students will select an environmental issue to become familiar with. Student will design an eco-label for a product that does not contribute to the specific environmental problem. (Example: Problem: What to do with used tires? Students find a company that recycles old tires into useful products. Student designs an eco-label for that company.)

Objective: Students will discover companies that are environmentally friendly.

Background: There is no current federal effort to publicize or list ecologically friendly products in the United States and little control over labeling. Research shows that most people are concerned about the environment and will buy products that they think will help the environment when given a choice. However, most consumers rely on the manufacturers' integrity rather than their own knowledge.

Leading Question: Should there be more control over labeling of products as to their environmental friendliness? Should more recognization be given to products that don't harm the environment?

Procedure:

1. Class discusses the idea of eco-labels and currently used eco-labels. Eco-labeling in Europe is also discussed by reading the article.
2. Class brainstorms ideas for other eco-labels that could be used on products that do not contribute to environmental problems.
3. Each student investigates the environmental topic of their choice. Students will read periodicals, newspapers, or Internet entries and collect summary notes. The notes are turned in with the eco-label. Each student must have a minimum of five articles from magazines and newspapers and books that are not older than 1990.
4. The student then designs an eco-label that would go on an existing product. The design should be the size of a half a piece of typing paper.
5. Under the eco-label, the student explains how their label reflects their topic in paragraph form. They also describe the type of product it would be used on.
6. Points are given for creativity, use of color and symbolism on label, quality of research, and a good conclusion paragraph explaining the label.

6.8

Eco-Label Project Cont'd.

What Now?

1. Discuss the hand-out on eco-labeling. Look for products that have eco-labels and think about their claims.
2. Do they seem realistic and accurate? Find out what the Federal Trade Commission guidelines are on labeling. (See appendix)
3 Write a letter to your local paper or your congressman concerning the issue of "Truth in Labeling."
4. Survey adults as to how labels that suggest environmental friendliness affect their buying choices.

Eco-labeling in the European Community

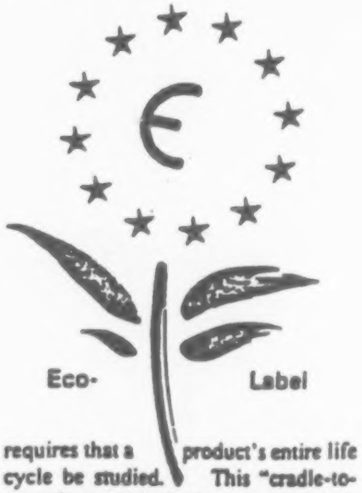
Last March the European Community adopted legislation designed to facilitate consumer recognition and purchasing of ecologically friendly products. EEC Regulation 880/92 established a Community wide eco-labeling system. Through the use of stringent criteria, the system will award products voluntarily submitted by their manufacturers or importers found to "ensure a high level of environmental protection," the right to bear the EC Eco-label logo.

Central to the Regulation's success is the hope that consumers and manufacturers will encourage each other to use and produce products that have a reduced environmental impact during their "entire life cycle." Former EC Environment Minister Carlo Ripa di Meana, who saw the Regulation become law during his tenure, argued that with its adoption "manufacturers would have an incentive to produce environmentally friendly products."

Evaluation of products will be on a product-by-product basis depending on the category of product group they fall into. Definition of product groups and their specific criteria is a function of an EC Commission and Member State Committee established by the Regulation.

As of October 1992 work defining criteria for 16 different product groups had begun. In an effort to get the labelling scheme running, Member States, depending on their interest and expertise, are helping the Commission determine the standards for the different product groups.

The UK is working on washing machines, dishwashers, light bulbs, soil improvers and hair sprays; Germany on solar heating systems, laundry detergents, dishwasher detergents and household cleaning products. Denmark is handling photocopier paper, kitchen towels, toilet paper, writing paper and insulation materials. France is responsible for paints, varnishes and batteries.



In determining the criteria for the different product groups the Regulation requires that a product's entire life cycle be studied. This "cradle-to-grave" approach divides a product's life into five stages: pre-production, production, distribution (including packaging), utilization and disposal. After defining the different life cycle stages for a given product, group standards are then set according to the overall environmental impact in terms of the amount of waste generated, potential soil contamination or water pollution, noise produced, consumption of energy and natural resources and impact on the ecosystem.

The Danish draft criteria for copier paper, for example, concerns mainly the production process. According to the International Environment Reporter: "The criteria address the raw materials used (modern forestry principles, no pulp from tropical rain forests, use of waste paper, and the like), energy use, specific emissions criteria for sulfur dioxide, chemical oxygen demand, etc., and regulatory compliance. In the qualification process, a producer's copier paper would be scored on each criterion. If the total score achieved exceeded the qualification threshold, the paper would qualify for the label."

While the copier paper criteria have met with acceptance from industry the International Environment Reporter reports that the Regulation's approach for creating product group criteria is not free from controversy.

In the case of light bulbs "the UK authorities determined that the primary criterion...which would apply to all general purpose bulbs with single-ended fittings, would be energy efficiency (a life cycle analysis established that energy consumption during the use phase was the overriding environmental factor)."

As a result only fluorescent bulbs will qualify for an eco-label award. The European Lighting Council, a Europe-wide industry group, opposed the criteria on the grounds that fluorescent bulbs are neither realistic nor available for all domestic applications and "that promoting them through an eco-label might result in consumer dissatisfaction."

Eco-labels and the review procedure for setting the product group criteria are not new to the EC. Europe's oldest eco-label, the German Blue Angel, was established in 1977. In June of 1992 both France and the Netherlands, drawing on Germany's experience, adopted eco-labels of their own. The German logo is a blue angel, the French a green flower, and the Dutch a hand holding a stamp that prints "environmental approval" (milieukeur). All three programs are supported but not run by their respective governments.

The EC eco-label system will not displace or preclude these or other eco-labelling systems. Compatibility with the EC-labeling scheme should not be a problem. The French argue that eventually they would like to merge their system into that of the EC's as long as the EC does not have less stringent standards. The Dutch on the other hand envision their system as a sort of supplement to the EC-system. Products will have to pass criteria more stringent then the ECs and will be evaluated for their environmental impact on the Netherlands.

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Healthy Harvest / March-April 1993

Planned Obsolescence - What Can We Do About It?

Grade Level : 6

Subject:
Science 2.6, 2.7, 5.1

Time:
two class periods

Setting:
classroom

Materials:
recent periodicals

Skills:
inferring, analyzing

Vocabulary:
obsolete
consignment stores

Source:
Master Waste Manger's Manual
NC Cooperative Extension Service

Summary: Students will examine advertisements for new products. Students will examine advertisement techniques being used to make the existing product seem obsolete while making new product more desirable.

Objective: Students will begin to understand the impact of advertisements on buying habits and how these habits affect the waste stream.

Background: There is quite a difference between a product that is obsolete because it is beyond repair and a product that is obsolete because it is out of fashion. A product that is obsolete because it is out of fashion is "planned obsolescence" and is the result of marketing. This strategy is designed to make the consumer discontented with "last year's model." The clothing industry is one industry that thrives on "planned obsolescence." Louis Cheskin of the Color Research Institute contends that "most design changes are not made for improving the products either aesthetically or functionally, but for making it obsolete". Planned Obsolescence contributes to the garbage problem and increases the consumption of energy and natural resources. According to a study by Franklin Associates in 1992, clothing discards grew by 260% from 1970 to 1988.

Leading Question: Could we reduce the garbage problem and save energy by being more aware of marketing strategies?

Procedure:

1. Ask each student to bring to class a one page recent advertisement for an article of outerwear clothing.
2. Working in groups of 4-5, have students discuss how the ad appeals to them and why.
3. Create a classroom list on the blackboard or chart paper as to techniques of marketing used. (Allow students to come up with own terms to suggest ad's appeal)
4. Move back to small group and discuss the last clothing purchase of each person in the group. What was it and why did you buy it?
5. Create a second classroom list as to reasons for purchase. Analyze reasons as to need or marketing pressures.

What Now?

1. Discuss what happens to clothing that no one wants or needs.
2. Have students come up with a list of appropriate questions to ask themselves before they make their next clothing purchase.
3. Start a clothing exchange program in your school. Ask local sanitation engineer, recycling coordinator, or public works director to estimate number of tons of unwanted clothing disposed of through the sanitation or public works department. Calculate disposal cost for this figure. Have a class yard sale. Donate funds to favorite environmental group or use for beautification. Contact local thrift store for donating used clothing.

Less Power Equals Less Waste

Grade Level : 6

Subject:
Science 2.1, 2.6, 2.7, 4.1, 4.2

Time:
one to two class periods initially - time must expand over a month period

Setting:
classroom

Materials:
packets of information provided by local power company representative

Skills:
analyzing
interpreting
inferring

Vocabulary:
a list of appropriate vocabulary will be available in local literature

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will list all activities that involve the use of electricity in their homes. Working with a local power company representative, a plan will be designed to reduce the kilowatt hours used by each student's family. At the end of one month, students will gain extra science credit if they have successfully reduced their electricity usage by a predetermined goal.

Objective: Students will understand that by reducing their consumption of electricity, they can save money and help the environment.

Background: In North Carolina, power is produced by the burning of coal or oil, nuclear power, hydroelectric, and thermoelectric. All these methods produce waste that creates a detrimental effect on the environment. Even the burning of wood for heat creates large amounts of air pollution locally. Our demand for power in the future will only rise. If we are to protect the air and water, we must learn more efficient power usage.

Leading Question: What impact does my use of electricity have on the environment?

Procedure:

1. Teacher should contact local power company to schedule a class presentation on the use of electricity in North Carolina.
2. Teacher will ask students to list all the ways they depend on electrical power in their home.
3. Teacher will ask students to obtain a copy of their last power bill. Students should have this copy in hand when the local power company representative comes to visit.
4. Working with the representative, students will devise a plan to reduce their family's power consumption.
5. After the plan has been in place for one month, students will bring a copy of the power bill during which the plan was in action.
6. Evaluate the plan's success by comparing the kilowatts of power used before and after the plan was put into action. Brainstorm as to external factors that would impact the bill - daily temperature, vacations, etc.

What Now?

1. Tally the total saving in kilowatt hours for the entire class. Assume that this electricity was obtained by burning coal. Discuss the environmental impact on reducing power usage.

6.12

Less Power Equals Less Waste (continued)

What Now? (continued)

2. Calculate the amount of money saved by each student. Maybe students could ask parents for an increase in their allowance that matches the saved money. Be sure that the money is not spent on items that cause increased power usage, for example, renting video games or movies.
3. Find out Time-of-use special rates. (Using power at off-peak hours.) Discuss advantages.

PACKAGING

Are You An Impulse Buyer?

Grade Level : 6

Subject:
Science 2.6, 4.3, 5.1

Time:
one to two class periods

Setting:
classroom

Materials:
copies of "Precycling Strategies" attached

Skills:
inferring, critical thinking, sorting, interpreting, analyzing

Vocabulary: precycling

Source:
Master Waste Manager's Manual
NC Cooperative Extension Service

Summary: Students will examine their buying habits and determine if they are impulse buyers. Students will then develop strategies to control buying habits.

Objective: Students will begin to understand that as consumers we have some choices and that these choices not only affect our budget but the waste stream. Students will learn strategies to avoid becoming an impulse buyer.

Background: As consumers, we are constantly bombarded by marketing campaigns to buy, buy, buy! The result is often abandoned items that end up in the waste stream. While purchasing new items may aid the economy briefly, the overall impact is determinal due to the consumption of energy and natural resources, added water and air pollution, and problems of disposal. When a new item is the best choice, this choice should be made carefully. This is called selective shopping or precycling.

Leading Question: As a consumer, can I reduce the waste stream and save money by developing purchasing strategies ?

Procedure:

1. Assign each student to survey their room or home for an item that they purchased that they later wished they could return. If possible, bring this item to class.
2. Working in teams or individually, have students answer the following questions concerning the purchase:
    a. Why did you purchase the item?
    b. What is the item used for?
    c. How often is the item used ?
    d. How long will the item last?
    e. How will the item (and it's packaging) be disposed of?
3. Create a chart of "reasons for buying." Analyze reasons as being logical or result of impulse buying.
4. Allow students to come up with their own precycling strategies. Share the list attached for comparison.
5. Develop a uniform list of strategies for precycling with saving money and saving resources as the objectives.
6. Ask each student to refer to this list before they make a purchase.

What Now?

1. Discuss the phrase "Shop Until You Drop". Should this phrase have a positive or negative connotation? Do most purchases in your class appear to be motivated by need ?
2. Ask each student to interview parents as to the last "useless" item they purchased and what the motivator was for purchasing. Ask students to share precycling strategies with their parents.

Precycling Strategies:

- Which stores offer the best precycling options at an affordable price?
- Is the product on the shopping list?
- Is the product made to last (reusable) or is it disposable?
- What is the product made of? (does it use recyclable materials or recycled content?)
- How much and what kind(s) of packaging are used?
- Can the packaging be reused or recycled?
- Can the purchase be bought in bulk?
- Does the purchase really need to be bagged?

Don't Throw That Away!

Grade Level : 6

Subjects:
Science 2.1, 2.6, 2.7
The Arts 1.0
Communication Skills 1.0

Time:
two-three class periods, assignment should be extended over approximately 1 week

Setting:
classroom, playground, gym

Materials:
student generated - any item that cannot be recycled in your area

Skills:
communicating, problem solving, critical thinking

Vocabulary:
generated by student activities

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will create a game from items that are generally thrown away. (Note: Items should not be recyclable in your area)

Objectives: Students will become aware of the potential for reuse of articles that often end up in a landfill.

Background: Packaging of food creates the bulk of items that cannot be recycled in most areas. By creatively using these items and by selective purchasing we can greatly reduce our disposal cost.

Leading Question: Are there items that could be recycled into games for others to enjoy as opposed to throwing them away? Can we reduce our disposal cost by recycling or reusing items that normally become waste?

Procedure:

1. Announce to children that they must select non-recyclable items to create a game that is appropriate for K-6 students. Children may work in teams of 2-4 depending on the game.

2. Allow children at least one week to complete games.

3. Ideas for games should be turned in to the teacher for verification.

4. Teacher will approve ideas and return to students.

5. One week later, students should present activity to the rest of the class. (A written, detailed description of the game must be turned in to the teacher.)

6. Class and teacher should classify game as to grade appropriateness.

7. If appropriate, game should be played in class. (Example: checkerboard created from cereal boxes, checkers from bottle caps).

8. Share games with K-6 teachers.

9. If possible, students should be released to demonstrate game and assist interested teachers. Students can attend faculty meetings to demonstrate their game or activity.

10. As students play their game, idea of reuse should be continually stressed to younger children.

Don't Throw That Away (continued)

What Now?:

1. Which reused item had the greatest economical impact on our area? (Focus on weight of item since disposal cost is computated by the ton.) Contact your local public works department to find out disposal costs.
2. Which item has the most environmental impact by intercepting it?
3. Which games can be saved or reproduced for later use?
4. Create a file listing all games and a brief description for the library as check out items.

Ideas for games: (allow students to come up with own ideas)

a. Bean bags from old clothing.
b. Building blocks for younger kids using cereal boxes or other.
c. Make playing cards or create own card game using cardboard from packaging.
d. Bowling game from dish detergent bottles.
e. Cut paper dolls and clothing from paper packaging.
f. Puppets from old socks and other clothing items.

Sample of Verification Form

Team Names

____

____

____

____

Game (Title): ____________________________________

Materials Used: __________________________________

____

____

Brief description of how your game works:

____

____

____

Turn in for approval by ____________________
(date)

The Case Of The Missing Trash Can

Grade Level : 6

Subjects:
Science 4.1, 4.2, 4.3, 4.4, 5.2
Math 5.0. 6.0, 7.0

Time:
activity should extend over one entire school day, with analysis at the end of the day or at the beginning of the second day.

Setting:
classroom

Materials:
an individual plastic grocery bag for each student & teacher,
stick-on name labels or permanent marker for labeling,
balance scale,
disposable gloves if requested by student (however, remind students that they are handling their own trash),
containers marked organic, inorganic, and compostable
calculators

Skills:
measuring, sorting, analyzing, modeling

Vocabulary:
organic, inorganic, recyclable, compostable

Source:
Watauga County Recycling Curriculum Committee

Summary: The trash can will be removed from the classroom for the entire day. Students and teachers will have their own individual trash bag into which they will place all waste for the day. Students will analyze their throw-away habits and attempt to reduce the mass of waste.

Objective: Students will focus on what they throw away and attempt to reduce the mass of waste they produce during the school day.

Background: We are accustomed to having trash cans available when we need them and most of us give little thought as to what happens to an item once we dispose of it. No longer is "out of sight, out of mind" an appropriate attitude about waste. Some areas of North Carolina no longer have a landfill to dispose of solid waste, but must pay to have every ounce of garbage trucked to other areas. By reducing the mass of our disposal items, we can save money and energy, preserve natural resources, and reduce pollution.

Leading Question: Could our class become less wasteful? Could we reduce the disposal cost to our county or city?

Procedure:

1. Remove all trash cans from the classroom. (If possible, obtain the cooperation of everyone in your area and remove all trash cans that are in areas where children go for classes during the day)
2. Give each child a grocery bag and a name label (teacher must use one also) to put all waste in during the day. (Note: Do not take bag to cafeteria. Lunch waste is covered in lesson ("How Much of our Lunch Becomes Waste?") See page 6.21
3. At the end of the day, have each student mass his bag and record the mass on the name label attached on the bag.
4. Ask each child to sort his/her waste into organic and inorganic piles. (Discuss how to identify organic and inorganic substances), mass each pile and record. Total all mass and determine the disposal cost. (Find out cost per ton for your local area)
5. Sort all items into recyclable, compostable, or disposable.
6. Mass all waste that must be placed in the trash can because it is not compostable or recyclable.
7. Compare the cost of disposal before sorting to the cost of disposal after sorting. Calculate costs over one year and then compare.

The Case Of The Missing Trash Can (continued)

What Now?

1. Can we, as a class, make a difference in the waste stream at our school? How about the disposal cost for our county/city? If every student in our school could sort recyclables and compostables from disposables during the school day, how much could be saved in disposal cost per year?

2. Challenge every student to carefully separate and recycle all items at home. Using your class as a model, calculate the amount of disposal cost that could be saved if all 6th graders in your school system separated and recycled.

DATA TABLE FOR NO TRASH CAN DAY

Name: ______________________________

Date: ______________________________

1. Mass of trash collected: ____________
2. Mass of organic matter: ____________
3. Mass of inorganic matter: ____________
4. Mass of recycled matter: ____________
5. Mass of compostable matter: ____________
6. Mass of matter that must be thrown away: ____________
7. Mass reduced: ____________

WASTE DISPOSAL

Disposal of Large Appliances

Grade Level : 6

Subjects:
Science 2.4, 2.6, 4.2, 5.1
Communication Skills 3.1

Time:
three to five class periods

Setting:
classroom, computer lab

Materials:
letter writing materials
word processor
addresses of state environmental agencies, congressman, etc.
access to Internet if possible (addresses and contact agencies are readily available here)

Skills:
analyzing
communications
critical thinking

Vocabulary:
landfill
recovering
CFC's
PCB's
capacitators

Source:
Municipal Solid Waste Management 1993 Teacher's Guide
Aurora Public Schools,
Aurora, Colorado

Summary: Students will write letters and/or send e-mail to government agencies seeking information on how large appliances (stoves, refrigerators i.e., white goods) are disposed of in their state, county, or city. Specifically, students will be seeking information associated with PCB's and CFC's and their effects on world ecology. Students will analyze the problems and come up with possible solutions.

Objective: Students will demonstrate knowledge of the problems connected with the disposal of large appliances and how they can impact the solutions.

Background: On one hand, it is very beneficial to replace an older appliance as they can demand as much as 50% more electricity than newer models. Problems arise, though, in their disposal. Large appliances (white goods) are banned from disposal in landfills in North Carolina.

Refrigerators, freezers, and air conditioners contain CFC's (Chlorofluorocarbons) which are known to be ozone depleting chemicals.

Many older appliances were built with capacitors that contain PCB's (Polychlorinated biphenyls) which may produce damage ranging from acute biological effects (complete sterilization of stretches of waterways) to chronic sub-lethal effects that may go undetected for years. Chronic low-level pollutants are proving to be the most difficult to correct and abate because of their ubiquitous nature and chemical stability.

The 1990 amendments to the Federal Clean Air Act, which went into effect July 1, 1992, prohibit any release of freon or CFC's and Hydrochlorofluorocarbons (HCFC's). In response to these requirements, some states and corporations are establishing recycling and buy-back programs for large appliances. North Carolina bans the disposal of white goods - stoves, refrigerators, freezers, washers, dryers, etc. - in landfills. The 1993 General Assembly (SB60) passed legislation placing an advance disposal fee (ADF) on white goods and requiring each county to report annually on their white goods management program. For local data call 919-733-0692 (Solid Waste Section).

Leading Question: Do you know what happens to an old air conditioner, freezer, or refrigerator when you replace it?

Disposal of Large Appliances (continued)

Procedure:

Discuss the long range problems of energy waste, pollution and environmental degradation outlined above. Write a collective letter that will be sent to government agencies in your state asking what they are doing:

1. to reclaim refrigerant materials
2. to reuse materials in discarded large appliances

When replies are received, analyze them to find a fitting follow-up activity. For example, send letters to the appropriate agency asking for a copy of the law that requires the recycling of white goods, or write letters of inquiry, asking for information on the specific things being done in their county or region in appliance recycling or disposal. Write or e-mail for information on PCB's and CFC's management programs in their city or county. Research North Carolina's problems with PCB accidents and clean-up. Contact the Hazardous Waste Section (919-733-2178) for more information.

Develop a chart that lists the agencies that you have contacted and their responses, followed by a list of recommended actions for improving the situation.

What Now?

1. Should we replace older appliances or repair them? What criteria should we use to make this decision? Does car air-conditioning use CFC's?

2. Invite an appliance recycler/repairman to your classroom to talk about what is currently the industry standard. Contact local car dealerships for information on car air-conditioning and CFC's.

WASTE DISPOSAL

How Much Of Our Lunch Becomes Waste?

Grade Level : 6

Subjects:
Science 2.9, 2.13
Math 1.3, 6.6, 7.12

Time:
one or two class periods

Setting:
classroom and cafeteria

Materials:
balance scale, bagged and cafeteria prepared lunches, zip-loc sandwich bag for each student

Skills:
inferring, interpreting, measuring

Vocabulary:
organic
renewable
non-renewable

Source:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Summary: Students will determine mass of lunch items before eating. After meal is complete, students will determine mass of materials to be disposed of and the cost of disposal.

Objective: Students will determine that waste can be reduced and disposal costs can be cut.

Background: It is estimated that about 15% of the total mass of food served becomes waste. This is not only a loss of valuable energy (food energy, processing, transportation, etc.) but also an added disposal cost. (see school example in appendix)

Leading Question: How much money could the schools in our county or city save taxpayers each year by reducing the amount of food related waste?

Procedure:

1. Students who have bagged lunches find the total mass before eating. For students who eat a cafeteria prepared lunch, assign one student to find mass of an average lunch.
2. After completing lunch, students collect all remaining food and packaging in a zip-lock bag and return it to classroom (Caution students not to change eating habits because of the experiment.)
3. Determine the mass of what would have been put in the cafeteria trash can.
4. Subtract figure in step 3 from figure determined in step 1.
5. Have each student complete hand-out "Lunch Bags."
6. Tally total waste produced by entire class.

What Now?

1. Discuss ways to reduce mass. Determine waste produced by entire school using your class as an average. Determine an estimated daily, weekly and yearly cost for disposal of food and packaging waste at your school.
2. Have a follow up day with objective being "low waste lunch day." Challenge students to reduce waste mass by 50% from first data collection.
3. Begin a compost pile at school and home. Encourage reusing and recycling.
4. On days that fresh, whole fruit such as apples, bananas, oranges or peaches are served in your cafeteria, collect fruit not eaten by students. Inspect and discard any fruit that is bruised or tampered with in any way. Store in a refrigerator. Carefully wash, slice, and serve the next day at student break time. (It will all be eaten!)
5. See "offer vs. serve" in appendix for ideas on reducing the amount of food waste.

6.22

How Much Of Our Lunch Becomes Waste? (continued)

SCHOOL LUNCH WASTE

Mass After Lunch:

Mass Before Lunch:

ITEM	FOOD	NON-FOOD		
		made of	renewable	nonrenewable
sample:				

1. Which category has the most waste? ______________________

2. Which has the least? ______________________

3. Which types of waste were reusable? ______________________

____

4. Which types of waste were recyclable? ______________________

____

5. What can we change to reduce our lunch waste? ______________________

____

____

WASTE DISPOSAL

Get A New Landfill?

Grade Level : 6

Subject:
Science 2.4, 2.6, 4.4, 5.1, 6.3

Time:
one week

Setting:
classroom

Materials:
video, "Waste Not Want Not" (this video can be purchased by calling 1-800-Learner or by writing to P.O. Box 1922, Santa Barbara, CA 93116-1922)
a transcript can be purchased for $5.00 by calling 1-800-TalkShow or writing to "Race to Save the Planet," 267 Broadway, Journal Graphics, New York, NY 10007

Skills:
inferring, critical thinking

Vocabulary:
leachate
lined landfill
incineration

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will debate the question, "Should our county or city look for options in waste disposal?"

Objective: Students will become aware of the waste disposal situation in their county or city.

Background: Landfills across North Carolina are monitored closely. All new landfills must be lined and built to strict specifications including the leachate collection system. Many local governments are looking for alternatives for waste disposal due to rising costs. Many are not choosing to build new landfills due to rising costs and other issues, but they are seeking disposal of solid waste in other locations that still operate landfills.

Leading Question: Do you know what happens to this milk carton after you throw it in the trash can?

Procedure:

1. Ask students to raise their hands if they know how their garbage is disposed.
2. Ask students this question "Do you think our county or city should look for other means of disposal?" Allow students to suggest ways. Record acceptable responses on the board or overhead.
3. Divide students into debate teams according to responses. Likely responses are:
   a. Build a landfill
   b. Build an incinerator
   c. Recycle, compost, and landfill
4. Ask students to be prepared to debate their stand in a few days.
5. Invite someone from the local sanitation department to speak to the class concerning the options for the future for waste disposal.
6. Visit a local landfill, recycling center or other solid waste management facility, if possible.
7. View the video, "Waste Not Want Not," part of the series "RACE TO SAVE THE PLANET." (This film is available at Appalachian State University or see information to left of page.)
8. Conduct a debate as to how to improve or solve the waste disposal problems that face your county or city.

Get A New Landfill?
(continued)

What Now?

1. Have students reflect changes that may take place in garbage disposal by the time they become taxpayers.
2. Have students share the information with their parents.
3. Attend a town or city council or county commissioner's meeting when waste disposal issues are to be discussed.

SEVENTH GRADE

TITLE	MAJOR TOPIC	PAGE NO.	SUBJECT AREAS COVERED
Sorting It All Out	3 R's	7.1	💡
Bikes and By-Products	3 R's	7.3	💡
Who Recycles In Your County or Community?	3 R's	7.5	💡 👥
Biomonitors and Bioindicators	3 R's	7.8	💡
Can Anyone Fix This?	3 R's	7.12	💡
Picture This	NATURAL RESOURCES	7.13	💡
Getting Involved	NATURAL RESOURCES	7.15	💡 👥
Small Things In Big Packages	PACKAGING	7.18	💡 👥 💵
Shoppers Beware!	PACKAGING	7.20	💡 👥
Compost - The End and The Beginning	WASTE DISPOSAL	7.22	💡 👥
Getting The Scoop	WASTE DISPOSAL	7.24	💡 👥
Build Your Own Landfill	WASTE DISPOSAL	7.26	💡 ⚖

Sorting It All Out

Grade Level : 7

Subjects:
Science 2.1, 2.2, 2.3, 2.5, 2.9, 3.1, 3.2, 3.3, 6.8

Time:
two classes

Setting:
classroom

Materials:
bags of household trash, disposable plastic gloves, balance scales

Skills:
gathering data, measuring, classifying

Vocabulary:
archaeology

Source:
Watauga County Recycling Curriculum Committee

Summary: Household garbage will be analyzed and contents compared to national waste stream composition.

Objective: Students will be able to compare typical household trash content to national solid waste stream figures.

Background: Our trash says a lot about our lifestyles. Thousands of years from now, archaeologists will reconstruct the civilization that exists today. Much of their understanding of us will be based on the remains of landfills. We may want to consider whether or not we would be proud of our future image.

Leading Question: How does the content of our trash compare with the national solid waste stream?

Procedure:

1. Bring bags of household garbage to school and sort it according to material.
2. Weigh each material and record in the attached chart.
3. Compare the results with the national figures given after the chart.
4. Answer the questions on the worksheet.
5. Construct graphs of national and family household garbage percentages.

What Now?

1. Analyze the waste at your school the same way you did from home.

2. Make a list of ways your school can reduce this waste.

7.2

Sorting It All Out (continued)

WORKSHEET

Sorting It All Out

Item	Material	Mass	% of Total

National Figures:		NC - Residential	NC - Commercial
-Paper	29.0%	31%	26%
-Glass	10.4%	8%	3%
-Ferrous	8.4%	6%	4%
-Aluminum	0.7%	1%	1%
-Other non-ferrous	0.3%	1%	1%
-Rubber, leather	2.6%		
-Textiles	1.6%	4%	4%
-Plastics	3.4%	10%	8%
-Food waste	17.8%		
-Yard waste	20.2%	5%	1%
-Misc. Inorganics	1.5%		

(Source: U.S. Environmental Protection Agency, "Fourth Report to Congress on Resource Recovery and Waste Reduction, p. 14)

Answer the following questions based on the above data:

1. What can be recycled?

2. What does the garbage tell you about a household?

3. What materials occur most frequently in household garbage?

Bikes and By-Products

Grade Level : 7

Subject:
Science 2.1, 2.6, 4.1, 4.2, 4.4, 5.1

Time:
one to two class periods

Setting:
classroom

Materials:
bicycle (ask a bike rider to borrow his/her bike)

Skills:
observing, inferring

Vocabulary:
hazardous waste
bauxite
chrome
by-products
toxic
flammable

Source:
A-Way With Waste,
Washington State Dept. of Ecology

Summary: Students will study the manufacturing of bikes and learn about the by-products that are created.

Objective: Students will learn that sometimes making the things we want creates hazardous waste.

Background : When natural raw materials are processed, waste is produced. This waste can be harmful. Bike production will involve plastics, synthetic fibers, synthetic rubber, paint and paint solvents, aluminum, chrome, coal, iron ore, steel and many others.

Leading Question: What kinds of hazardous by-products were created in building this bike?

Procedure:

1. As you display a bike in front of the class, ask: "How many of you have bikes?"
2. Ask the class to sketch the major parts of the display bike.
3. Lead the class in a discussion of the following:
   a. What natural resource was used to create each part?
   b. Where does this natural resource come from and is it renewable or nonrenewable?
   c. What by-products resulted with the production of each component?
   d. Which of these by-products are hazardous?
   e. Are there ways to lessen the impact of these hazardous materials?

What Now?

1. As consumers, how can we influence the bike industry to do a better job in preventing hazardous waste problems?

2. List other products that might produce the same hazardous waste as the manufacturing of bikes.

3. Ask parents to borrow manual for the family car. Identify a hazardous by-product from the manufacture of a car. Write the manufacturer for information on how they manage this hazardous waste.

4. Find out if manufacturers have substituted less hazardous materials today. (Example: using latex based paint versus oil based paints.)

By-Product & Waste Information From

Liquid Waste of Industry,
Nelson L. Nemerow, Addison-
Wesley Pub. Co., Menlo Park,
CA, 1971

Chromed & Plated Metal Parts

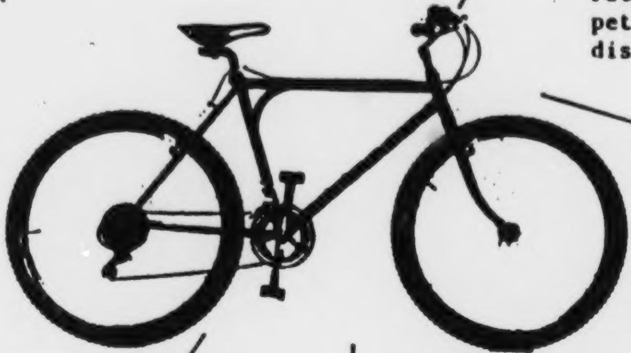
Materials
Chrome, nickel,
copper, zinc.

By-Products & Waste
(Highly toxic liquid wastes)
Acids, chromium zinc, copper, nickel, tin, cyanides.

Handle bar grips, plastic seat cover, paint, synthetic fibers, synthetic rubber tires

Materials
Petroleum & petroleum distillates.

By Products & Waste
Waste oil from leaks, caustic & acid sludge, alkaline & acid waters, acid gases & filtering clays.



Frame & Other Metal Parts

Materials
Iron ore & coal to make steel.

By Products & Wastes
Ammonia, tar, acids (pickling liquor waste), blast furnace flue dust.

Paints & Coatings

Materials
pigments
solvents
resins
cleaners

Wastes
paints
solvents
cleaners

Fenders & Other Metal Parts

Materials
Aluminum from Bauxite.

By Products & Wastes
Large volumes of "Red Mud" consisting of iron oxide, titanium & silica.

Who Recycles In Your County or Community?

Grade Level : 7

Subjects:
Science 2.4, 4.2, 5.1, 6.8
Communication Skills 2.2, 3.1, 3.2, 4.2

Time:
two to three class periods

Setting:
classroom

Materials:
county or city maps, copies of Waste Reduction policies and recycling schedules for location

Skills:
communicate, classifying, inferring

Vocabulary:
Bottle Bill, compostable

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will survey businesses in the county/city as to their involvement in the community's recycling and reduction programs. Once the survey is complete, students will recognize businesses that participate in waste reduction programs by writing thank you letters. Businesses that are not participating will receive a letter requesting that they consider recycling and waste reduction as a company policy.

Objective: Students will become aware of response of businesses to local recycling program. Students will learn interview procedures and practice letter writing skills.

Background: Many counties and cities have recycling facilities in convenient locations to encourage citizen participation.

Ten states have a "Bottle Bill." When a bottled drink is sold, a 5-15 cent deposit is charged which the consumer regains when the bottle is returned for recycling. North Carolina does not have such a bill.

Leading Question: Do your parents' employers participate in the local recycling program?

Procedure:

1. Make a list of all employers represented in the class.
2. Identify enough businesses so that each student has at least two places to interview. This should be their parents' employer and one other business.
3. Demonstrate proper interviewing techniques then allow students to practice by role playing. (Student should always state name and purpose.)
4. Assign students to complete interview . (See attached)
5. Compile results.
6. Write letters thanking businesses who participate in the community's recycling program and write letters of request for participation to businesses who do not recycle.
7. Using local maps, locate all recycling services within your area. Encourage parents to volunteer to start a recycling program in their place of employment.

Who Recycles In Your County or Community? (continued)

What Now?

1. What percent of businesses interviewed recycle?

2. Should businesses be required to recycle?

3. Who pays the increased disposal cost when businesses fail to recycle?

4. Make a list of businesses who participate. Call local newspaper to publish your results.

5. Make flyers, banners, etc., (on recycled paper) to honor businesses who are good recyclers. Display these in the school and in other public places.

6. Fax a copy of your results to all businesses interviewed.

***Note:** Interview should be done with someone in management only. Students should always conduct the interview in person if possible. A phone interview would be second choice, with mail interview being last choice.

Sample Interview Form

Date:

Name of Business:

Person being interviewed:
Title:

Person doing the interview:

Interview Questions:

1. Are you aware of the recycling program in your community?

2. Is there a drink machine located on the premises? If yes, what type containers are used (glass, plastic, aluminum)? Are recycling containers provided for employees?
Are you familiar with the concept of a bottle bill? (if answer is no, student should explain) Would you favor such a law in NC? Explain.

3. What paper products are used in your business? Are any of these recycled?

4. Are any metals, such as steel, copper, tin, or aluminum used in your business? If so, are any of these recycled? If answer is yes, please explain what and how metal is recycled.

5. Do you keep any type of records to track your volume of recycling?

6. Does your business in any way encourage recycling in the work place? If yes, explain.

7. How do you dispose of your solid waste?

8. What does the majority of your waste consist of? (paper, metal, cardboard etc.)

9. Who pays for waste disposal?

10. Is any of your waste considered hazardous? If yes, where does it go?

11. Would you be in favor of required separation of recyclable and compostable materials?

12. Do you offer or would you consider offering incentives to employees for recycling?
Explain.

13. Of all the items that could be recycled in your place of business, what percent do you estimate is recycled?

14. Do I have your permission to make public the information you have provided me in this interview?

15. Do you wish to comment on any questions or make any further statements concerning recycling?

Biomonitors And Bioindicators

Grade Level : 7

Subject:
Science 2.1, 2.4, 2.6, 2.9, 4.1, 4.2, 4.3

Time:
This activity is long-term. Students should make entries in field notebooks or databases weekly or more often if warranted.

Setting:
field and classroom and/or computer lab

Materials:
notebooks, art supplies, reference materials, field guides to trees, wildflower, birds etc.

Skills:
observing, record keeping, inferring, comparing, contrasting, interpreting data

Vocabulary:
biomonitors
bioindicators
field notebook

Source:
Watauga County Recycling Curriculum Committee

Summary: Students and teacher will survey outside area of school for plants, shrubs, trees or birds that might be used as biomonitors or bioindicators. Students will carefully keep drawings and records of the selected species throughout the school year, specifically looking for any variances that might be related to changes in environment due to human activity.

Objective: Students will learn that plant and animal populations in a given area can be used to monitor or indicate environmental changes and the effects these changes have. By participating in this activity, students will become more aware and more appreciative of their natural surroundings.

Background: Two study examples are the milkweed population and a specific bird population. Milkweed is sensitive to ozone and certain birds thrive in specific areas. A sample entry page for milkweed is included. Besides showing reduced growth, the EPA has identified six classes of ozone damage. These are:

- Chlorosis: a yellow mottled discoloration
- Tip burn: a yellowing and browning of the tips of conifer needles.
- Stippling: a water-soaked area on the leaf.
- Flecking: numerous dot-like spots on the leaf
- Bleaching: small white or black spots on the surface on the leaf.
- Pigmentation: a larger paper-thin area of the leaf ranging in color from white to red-orange.

A rule of thumb observation to distinguish ozone and other air pollution damage from insect damage is to observe the penetration of the leaf surface. If damage is on the top part of the leaf only, damage is probably due to some type of air pollution damage, such as ozone. If the damage extends through the leaf surface and can be observed on both sides, this is probably caused by insect damage.

Long term records of specific plant and animal populations, along with climatic conditions, are an invaluable asset to science. Some students may wish to leave their field notebooks for a student to continue in proceeding years. Others can set up permanent databases that can be added to indefinitely.

Note: A yard-sale enthusiast recently purchased a field notebook from the 1930's for $5.00. Later, he sold the notebook for $250.00.

Leading Question: Did you know decreasing milkweed population can indicate ozone build up in the atmosphere?

Biomonitors And Bioindicators (continued)

Procedure:

1. Discuss with students the meanings of biomonitors and bioindicators.
2. Take a walk around your school to locate plants, shrubs, trees, or birds that might make good candidates for biomonitors or bioindicators.
3. Guide students to select plant species that are likely to be undisturbed in the near future. If selecting a bird or other small animal, entries will vary according to the activity of the species.
4. Assign students to learn as much as possible about their species, requiring a brief (not more than one page) entry in notebook with general information.
5. Record in field notebook and/or database on a regular basis.
6. Discuss one example entry after each recording session.
7. Summarize each entry under observations.

What Now?

1. Using student entries as a focal point, ask students to speculate as to how recycling could affect habitats of their species.
2. Encourage students to expand activity outside school by offering extra-credit for field notebooks kept on other species. Trips to parks, playgrounds, campgrounds, hiking trails, and family vacations are great places for field notebook enthusiasts.
3. If field trips are planned during the year, require at least one entry in notebook on a species observed.

BIOMONITOR / BIOINDICATOR DATA ON MILKWEED Page 1

Date:

Temperature:

Weather Conditions:

Number of plants monitored:

Condition of specimen:
Size - (average)
  height
  stem circumference
  length of leaf
  width of leaf

OBSERVATIONS:

Sketch of any unusual or noteworthy observations:

SAMPLE ENTRY

MILKWEED

General Description:

Scientific Name:

Site: (Example) Along river, west side of playground, near parallel bars, Cove Creek School

Beginning Date of Study: 8/22/94

Name of Researcher: Justin Jones

Teacher: Mrs. Miller

School: Cove Creek Elementary, Watauga County, NC

Sketch of study area should appear here

Can Anyone Fix This?

Grade Level : 7

Subject:
Science 4.2, 4.3, 6.8

Time:
one class period

Setting:
classroom, shop if available

Materials:
broken tools, clothing needing repairs, broken toys - repair equipment such as pliers, hammer, drill, files, glue, sandpaper, assorted needles and threads, etc.

Skills:
measuring, predicting, observing , manipulative skills

Vocabulary:
as generated by activity

Source:
A-Way With Waste, Washington State Department of Ecology

Summary: Students will be asked to bring to school one item that needs repair. A "repair day" will be designated, tools collected, and repairs made.

Objective: Students will learn that by making simple repairs to products such as small appliances, garden tools, clothing, toys, etc., the waste stream can be reduced.

Background: This activity can be done before or after "What is Planned Obsolescence?"- page 6.10. Many consumers find it more convenient and less expensive to replace an item than to repair it. However, they often do not consider the loss of natural resources, energy, and the cost of disposal. This activity is designed to show how simple repairs can save money, natural resources and energy, and reduce disposal fees.

Leading Question: Do you have a favorite pair of jeans, a shirt or other clothing item that you have not worn lately because it needs repairing?

Procedure:

1. Collect items in need of repair.
   a. Ask student to bring items from home, friends, etc.
   b. Put a note in teacher mailboxes or mailroom, asking for donated items to be repaired.
2. Based on items that need repair, collect anticipated tools needed.
3. Schedule and carry out a repair day.
4. Discuss the cost savings of repairing products as opposed to purchasing replacements.
5. Allow students to return item repaired to its owner.
   Example of product to repair: Jeans with a broken zipper
   Invite a seamstress to class to demonstrate the replacement of a broken zipper. If setting is in vocational area, sewing machines should be readily available. Cost of zipper repair is minimal compared to the cost of new jeans.

What Now?

1. List some tools that are often thrown away that could be repaired.

2. Find the total mass of all repaired objects and calculate same disposal cost.

3. What cost other than replacement should be considered when options are repairing or throwing out?

4. Have interested students volunteer to repair broken items around their own home or neighborhood. Collect donated broken items, repair and have a yard sale.

NATURAL RESOURCES

Picture This

Grade Level : 7

Subject:
Science 2.1, 2.4, 2.6, 2.8, 5.1

Time:
lesson should span a least two weeks or more

Setting:
school grounds, community, school

Materials:
cameras, dark room for developing and printing of film, black and white film

Skills:
photography, developing of film, writing, observing

Vocabulary:
none

Source:
A-Way With Waste, Washington State Dept. of Ecology

Summary: Students will locate places around their school or neighborhood where litter is a problem. Students will then take pictures and display them, drawing attention to the area needing clean-up. Students will become active in cleaning up and maintaining the site.

Objective: Students will develop awareness of the unsightliness of litter and will be motivated to accept ownership of clean-up and maintenance of the area.

Background: The fine for littering (first offense) in NC ranges from a minimum of $100.00 to a maximum of $500.00. Second (or latter) offense could go as high as $1,000.00. Littering on federal property, such as the Blue Ridge Parkway, is also subject to a $500.00 fine. Litter bags are not required in vehicles or boats in NC, but in some states this is law. It is illegal in NC to drive a vehicle with materials that are loose and falling off. The presence and clean up of litter cost tax money. Certain areas of NC depend upon the tourist industry as a major part of their economic base. Litter is unsightly and discourages visitors with money to spend.

Leading Question: Are there areas of your school and/or community that need to be cleaned up?

Procedure:

1. Assign students to look for an area around their school or community that has a litter problem.
2. Ask students to speculate as to why there is a litter problem here. (Example: area surrounding your high school's athletic field is littered because students and visitors do not properly dispose of wrappers and drink containers.)
3. Assign students to take photos of area identified.
4. Develop and enlarge prints for a display in school lobby or other conspicuous place.
5. Assign students to write poems or brief narratives, reacting to the photos. Writings are to promote recycling and proper disposal.
6. Display photos and writing in school, churches, community centers, libraries, etc.

Picture This (continued)

7. Ask students to design and carry out a plan to clean up and monitor their identified area.

8. Take follow-up photos after clean-up .

9. Design a "before and after" bulletin board that will be rotated to appropriate places in the community and school.

What Now?

1. Should your community develop a plan to curtail littering?

2. Should business locations be held responsible for keeping their parking lots and surrounding areas clean?

3. Contact local newspapers for possible use of photos and story.

4. Design a map, pinpointing problem areas, and present findings to local town and county government.

5. Encourage students to become involved in the "Adopt-A-Highway Program" with their family, church, or civic group. (Call local Department of Transportation for information.)

NATURAL RESOURCES

Getting Involved

Grade Level : 7

Subjects:
Science 4.2, 5.1
Communication Skills 1.2, 1.3, 3.1, 3.2, 3.3.

Time:
one class period

Setting:
classroom

Materials:
natural resource cards
list of situations

Skills:
communicating, formulating questions, problem solving

Vocabulary:
resource, environment

Source:
Watauga County
Recycling Curriculum
Committee

Summary: Students will evaluate different situations in terms of environmental impact.

Objective: Students will become aware of how destructive environmental habits impact on everyone.

Background: Protecting our environment involves more than being careful about our own disposal habits. We, as a society, must become aware of what is happening around us and the damage being done by other individuals or groups. Preventing environmental protection law violations has become the responsibility of every citizen.

Leading Question: How do our activities impact on the environment?

Procedure:

1. Divide class into small groups of 4-5 students.
2. Discuss the importance of protecting our environment in terms of our local economy.
3. Distribute a natural resource card to each group. Each group is to be responsible for protecting this resource.
4. Read individual situations to the class. Ask each group to answer the following questions in terms of their resource and each situation.
    a. How does this situation help your natural resource?
    b. How does it harm your natural resource?
    c. Is this a good or bad situation for your resource?
    d. What are possible alternatives?

SITUATIONS FOR GETTING INVOLVED

1. Appsugarbee Ski Resort is expanding to add 3 new ski lifts and a huge restaurant at the top of the ski slope with a wrap around motel to accommodate skiers.

2. With all the local printers in the area, hundreds of gallons of chemical wastes are generated each month. These materials are being dumped in Jane Doe Creek by one of the printers and amounts to 40 gallons a month.

3. Fishing for catfish in a local river, a party of twelve dumped beer bottles, polystrene coolers, sandwich bags and plastic rings into the water. One fisherman lost his entire rod and reel with all the line attached.

7.16

Getting Involved (continued)

4. It's spring and all the Harleysaki motorcycle club members have converged on your town. The smoke from the exhausts of the motorcycles can be seen long before the cycles themselves come into sight.

5. The Acme Rubber Factory produces several hundred pounds of waste each week. This is illegally dumped into the Land Ducks Pond when no one (they think) is looking.

6. All the untreated sewage above the reservoir and rainwater contaminated with automobile oil flows directly into our water source.

7. The landfill in our town has closed because it was causing groundwater contamination. This town now must haul its trash to another landfill in another county.

8. Fly-By-Night Tool Plant recently closed and it has been discovered that the water surrounding the plant is contaminated and must be cleaned up.

9. A local electrical company has decided to put a huge generator behind an elementary school to produce electricity for customers several hundred miles away. The area around the school is often foggy and the plant produces particles that fill the air and make visibility poor. The generator also makes a lot of noise (more than a school).

10. A mall has been built in the flood plain of the main stream that flows through the town. The stream overflows its banks every time there is a heavy rain.

What Now?

1. Write an essay on an actual situation in your community that is a threat to our natural resources. What are some solutions to this problem?

2. Consider a situation that is a threat to our resources (e.g. the destruction of the fir trees on Mt. Mitchell) and trace the impact of this threat back to you personally.

PLANTS

MINERALS/OIL

ROCKS

ANIMALS

PACKAGING

Small Things In Big Packages

Grade Level : 7

Subjects:
Science 2.2, 2.6, 2.9, 2.14, 6.8
Communication Skills 2.0
The Arts 2.2

Time:
two class periods

Setting:
classroom
home

Materials:
balance

Skills:
measuring
gathering and interpreting data

Vocabulary:
non-renewable
renewable

Source:
Watauga County
Recycling Curriculum
Committee

Summary: In this activity, students measure the volume of materials used to package the food items they consume for one meal.

Objective: To become aware of and reduce the volume of natural resources wasted on unnecessary packaging and to make wise choices in packaging.

Background: Many companies make a habit of increasing the size of the package they use to distribute their products because this makes the product more visible to the consumer. This practice, added to necessary packaging, is increasing the depletion of our natural resources.

Leading Question: How much packaging is necessary for consumer products, and what can we do to reduce the use of packaging?

Procedure:

1. Collect and make a list of all the containers you used in packaging the foods you ate for dinner last night.
2. Mass these materials on a balance and record.
3. Using the library for a resource, complete the attached worksheet.
4. Look on your supermarket shelves and in your pantry for examples of over-packaged products. Bring some examples to school and estimate how much this excess packaging adds to our solid waste disposal problems.
5. Design a new package for a product that will reduce its volume of packaging.
6. Have the class vote on the most original and waste-reducing package.

What Now?

1. Brainstorm ideas for students to reduce their use of packaging. Have students keep a log of package reducing practices for two weeks and report these to the class.
2. Have students keep a running list of outrageously packaged products when they find them in stores. Set aside 5-10 minutes a week, to let students share these.
3. Ask the vocation teacher to have students make reusable shopping bags (or lunch bags) for parents or for sale.

Small Things In Big Packages (continued)

WORKSHEET

Use the chart below to record information you collect about the packaging used for the food you eat tonight. You may have to do some research before completing the chart.

Item	Mass	Original Material	Renewable Resource	Non-Renewable Resource

PACKAGING

Shoppers Beware!

Grade Level : 7

Subjects:
Science 4.2, 4.3, 5.1
Communication Skills 1.0, 2.0, 3.0

Time:
two class periods

Setting:
classroom, supermarket

Materials:
worksheet

Skills:
communicating, hypothesizing, recording and interpreting data.

Vocabulary:
purchasing criteria
recycling

Source:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Summary: In this activity, students will visit a local supermarket and interview shoppers to find out why they buy the products they buy.

Objective: Students will assess purchasing criteria of shoppers, determine the influence of packaging on consumer choices, and determine whether or not consumers consider packaging and waste disposal in their purchasing decisions.

Background: For products on the market today, packaging is often chosen for appearance rather than environmental protection. This has led to over-packaging and misuse of natural resources.

Leading Question: How do we determine which products to buy?

Procedure:

1. Discuss the motives for buying different products.

2. Using the attached worksheet, have students interview shoppers at a local grocery store to find the answers. (This assignment might best be given on a Friday and completed over the weekend. Be sure to obtain permission from local stores.)

3. As a class, analyze and chart the results of the poll. Answer the following questions:
   - What were the most common reasons for buying a food product?
   - What percentage of shoppers were concerned about waste disposal costs and options when deciding what to buy?
   - How often was the option of recycling taken into account?
   - How many shoppers were aware of local recycling programs?

What Now?

1. Have students evaluate their own family's shopping habits.

2. Publish the class findings in the local newspaper.

3. Compile an information pamphlet to give out to shoppers next weekend. Include such information as location of recycling sites, materials recycled, location of Goodwill or thrift store or contact your local recycling coordinator for information or brochures.

Shoppers Beware! (continued)

Survey Sheet
for
Shoppers Beware!

NAME ____

DATE ______________________

1. Which of the following factors influenced your decision to buy this product?
   - a. cost per pound/ounce
   - b. convenience in preparation
   - c. advertisement
   - d. high nutritional value
   - e. lack of artificial coloring, flavoring, or preservatives
   - f. reusable or recyclable packaging
   - g. you are having company
   - h. trying something new
   - i. catchy packaging—visually attractive
   - j. a friend recommended it
   - k. it was on sale
   - l. buying it for the kids
   - m. uses less packaging than other brands
   - n. you are familiar with the brand
   - o. you have used this product before
   - p. durability
   - q. other reasons

2. Does the recyclability of the product or its package play a part in determining what you buy?

3. When buying, do you think of how easy or difficult the product or its package will be to dispose of when you are finished with it? Was the least packaged item purchased?

4. Do you know where you could recycle this item locally?

5. If item is not recycled locally, did consumer purchase bulk or refillable product?

WASTE DISPOSAL

Compost - The End and The Beginning

Grade Level : 7

Subjects:
Science 2.1, 2.4, 2.7, 2.9, 2.12, 3.3, 4.2, 6.8
Communication Skills 3.0

Time:
several weeks

Setting:
outdoor class

Materials:
organic waste, soil, five-five gallon buckets with holes drilled in sides, thermometers, data tables created by students

Skills:
observing, communication, predicting, interpreting data, controlling variables, manipulative skills

Vocabulary:
compost
cycle
nitrogenous materials
chemical reaction
metabolize

Source:
A-Way With Waste, Washington State Dept. of Ecology.

Summary: Students create 5 experimental conditions to determine best recipe for compost.

Objective: Students will learn basic principles necessary to construct a good compost pile. Students will understand how composting can reduce household waste volume, decrease disposal cost and improve soil fertility.

Background: There are numerous manuals and instructions available on how to make good compost. Almost any organic matter can be decomposed in a compost pile. However, in order to avoid attracting rodents and other animals, you should eliminate dairy products and meat products. Ask if your community provides composters upon request.

Leading Question: How is composting related to recycling?

Procedure:

1. Learn the basics of composting by reading about various methods of making compost and alternatives for compost bins and containers.

2. Collect compost ingredients (vegetable scraps, bread, grass, leaves, etc.)
   a. Ask each student to collect at least one gallon of compostable material and bring to school.
   b. Ask students who have access to horse or cow manure and grass clippings to supply class with these essentials.

3. Using grass clippings, manure, weeds, hay, sawdust, coffee wastes, etc., start five small experimental compost piles. Remind students to exclude bones, meat, grease and dairy products.

4. Using the five 5-gallon buckets with holes drilled in the sides, create five compost piles.

5. Create five experimental conditions:
   a. Low in nitrogen
      . no manure or organics that are high in nitrogen
      . moisten, don't soak - keep moist
      . turn over regularly, every 2-3 days at first, then once a week
      . include a variety of moist ingredients: weeds, clippings, leaves, vegetable scraps, coffee grounds, etc.

Compost - The End and The Beginning (continued)

b. Not enough moisture
  - include manure and contents which are high in nitrogen
  - turn regularly
  - have a good mixture of ingredients (carbon and nitrogen)
  - don't water at all and make an effort not to add ingredients with a lot of moisture in them

c. No air circulation
  - include nitrogenous materials
  - good moisture of ingredients
  - keep moist
  - do not stir

d. Too much of a single ingredient
  - put all leaves or grass clippings in this pile
  - moisten
  - stir regularly

e. Good compost pile
  - include nitrogenous and carbonaceous materials (manure and bone meal are good sources of nitrogen)
  - keep moist
  - stir regularly
  - include a good mix of ingredients which are layered

6. Keep a daily record of the temperature of each pile in data tables.
7. Evaluate results after a few weeks.

What Now?

1. Discuss why one pile breaks down waste faster than others.
2. What appears to be the essential ingredients in a good compost system?
3. Discuss how composting is related to the concept of recycling.
4. If approximately 25% of your community's garbage could be composted, what would be the savings in disposal cost per year to the taxpayers?
5. Begin a compost pile at home. Use your compost to enhance gardens and flower beds or donate to neighbors.
6. Discuss the economics of paying someone to dispose of compostable materials.

WASTE DISPOSAL

Getting The Scoop

Grade Level : 7

Subjects:
Science 2.4, 2.6, 2.7, 2.9, 6.8
Communication Skills 1.0, 2.0, 3.0

Setting:
classroom

Materials:
worksheet

Skills:
researching, interviewing

Vocabulary:
per capita

Source:
A-Way With Waste,
Washington State Dept. of Ecology

Summary: The class will contact various officials who deal with waste disposal in their community and discover how we dispose of waste materials and what steps are being taken to improve the way the community handles waste.

Objective: Students will become aware of waste disposal and management practices in use now and how these plans will change in the future.

Background: Students need to become informed as to how solid waste is managed in their communities. Building a knowledge base can help students become responsible decision-makers as they prepare to move into the adult world.

Leading Question: How is solid waste managed in our community?

Procedure:

1. Form small groups (3-5 students).
2. Assign each group one of the following activities:
   a. Contact a private hauler and find out how they are handling the solid waste in your community. You can use the worksheet or ask for any pamphlets or brochures available. Report your findings to the class.
   b. You may also contact the local public works department for a list of private haulers or look in the yellow pages.
   c. Interview a county commissioner or city council person. Find out how your local government plans to manage solid waste in the future. You may also use the questions on the worksheet as an interview guide. (Contact the courthouse for a list of commissioners.)
   d. Visit your community's recycling center. Write a report on the recycling process in your community.
   e. Ask a member of the local Sierra Club or other environmental group to speak to the class about the efficiency of waste management in your community and alternatives to what we now do.
3. Provide time for groups to give oral presentations about their findings.

What Now?

1. Write an alternative waste management program for the community using the information you have found in this activity to justify your reasoning.

WORKSHEET FOR GETTING THE SCOOP

1. How much and what kinds of materials are discarded by our community?

2. Where are these materials finally disposed of?

3. How much does solid waste disposal cost and who pays for it? (disposal, hauling, management)

4. How and where will solid waste be handled and/or disposed of in the future?

5. How will future disposal sites be chosen?

6. At the present population rate of the community and our waste per capita, what quantities of solid waste will be generated in the future? (More or less than now?)

7. What will happen to the cost of solid waste disposal in the future? Why?

8. Do you think we have made adequate preparations for the future? Why?

9. If you had the ability to change any aspects of the plan for future solid waste disposal in your community, what would you do?

10. From your research, make recommendations on how individuals in your community might become involved in determining future courses of action regarding solid waste disposal and management.

11. What individual action might you take to alleviate the problem of solid waste disposal in your community?

Build Your Own Landfill

Grade Level : 7

Subjects:
Science 2.1, 2.9, 2.14
Math 6.1, 6.3

Time:
one class period to set up landfill, one to two periods two to three months later to analyze waste

Setting:
classroom

Materials:
five gallon ice cream container with two lids or any durable five gallon container; clear plastic bag; some garbage; various types of metal, plastic, paper, glass, leaves, twigs, and food; dirt; three bricks or stones; graph paper; pH paper; thermometer

Skills:
observing, classifying, interpreting data, experimenting, controlling variables, formulating hypotheses and models

Vocabulary:
indicator, decomposition

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will build a landfill as a method of waste disposal.

Objective: Students will become aware of the process of decomposition in a landfill.

Background: It is popularly believed that the materials in a landfill decompose quickly. The truth is that very little of what ends up in a landfill decomposes.

Leading Question: How long does it take for different materials to decompose in a landfill?

Procedure:
(This should be a class project with one landfill for the group)

1. Cut holes in the sides of the container.
2. Make a cut in the lid from the center to the outer edge.
3. Make a 1/2 inch diameter cut in the center of the lid and in the bottom of the container.
4. Fold the container lid together so that the cut edges overlap and it will fit into the bottom of the container.
5. Pull the bottom of the plastic bag through the hole in the lid (about 1/4 the way) and overlap the bottom of the container. The bottom of the plastic bag will catch the leachate. Secure the top of the bag around top of container with a rubber band.
6. Fill the container with layers of garbage. Cover each layer of garbage with 1/4 inch of soil.
7. Fill container 1/2 to 3/4 full. Place it on the bricks and place the second lid on the container.
8. Take the following measurements weekly:
   - pH reading (use hydronium or litmus paper)
   - temperature (insert thermometer through observation hole)
9. Graph the above information.
10. At the end of 2-3 months, empty the bucket and make a list of those materials that decomposed completely, partially, and not at all. Complete the attached chart.

What Now?

1. Discuss the implications of your findings on the future of landfills as a method of solid waste disposal.

2. What are alternatives for disposing of materials that will not decompose in a landfill?

Build Your Own Landfill (continued)

CHART

Decomposed	Partially Decomposed	Completely Decomposed	Not at All

EIGHTH GRADE

TITLE	***MAJOR TOPIC***	***PAGE NO.***	***SUBJECT AREAS COVERED***
Building An Aerobic Compost	***3 R's***	***8.1***	💡
You Become The Expert	***3 R's***	***8.5***	👥
Making Paper	***3 R's***	***8.20***	💡
Taking A Closer Look At School Trash	***3 R's***	***8.24***	💡 👥 ⚖
Creating Something Out of Nothing	***3 R's***	***8.26***	🎨
A Penny Saved	***3 R's***	***8.27***	💡 ⚖
Reducing Waste In The Home Environment	***NATURAL RESOURCES***	***8.29***	💡 ⚖
Where Does It All Come From?	***NATURAL RESOURCES***	***8.35***	💡
Junk Mail Connection	***PACKAGING***	***8.39***	💡
What's In That Package?	***PACKAGING***	***8.42***	💡 ⚖
What's Happening To It All?	***WASTE DISPOSAL***	***8.44***	💡 👥
Learn To Burn	***WASTE DISPOSAL***	***8.51***	💡

Building An Aerobic Compost Pile

Grade Level : 8

Subject:
Science 2.1, 2.2, 2.3, 2.4, 2.5, 2.6, 2.7, 2.8, 2.9, 2.10, 2.11, 2.12, 2.13, 2.14, 3.1, 3.3, 5.1

Time:
ongoing project, two to three class periods for initial work and five to ten minutes for 14-21 days.

Setting:
classroom, outside compost site

Materials:
compost bin (a 50 gallon garbage can is a good container or a pen made from chicken wire), pH paper, graph paper, Celsius thermometer

Skills:
science - collecting data

Vocabulary:
anaerobic
aerobic
compost
decomposition

Skills:
science - collecting data

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will collect organic materials including raw food scraps, leaves, and grass clippings to produce compost that can be used on the school grounds.

Objective: Students will learn skills, methods, and techniques necessary to build a compost pile and will understand the value of recycling solid waste in this way.

Background: Compost is a material that is the end product of combining organic materials and allowing them to decompose. The decomposing mixtures generate heat as a by-product. The end product is a carbon and nitrogen-rich material called humus which can be used as an additive in gardens and lawns.

Leading Question: How can organic materials be made into a useful product for use in gardens and lawns?

Procedure:

1. Prepare a compost bin using a large garbage can or build a pen with chicken wire. (Pallets for a bin may also be used or a purchased bin may be used.)
2. Have students bring food scraps, grass clippings, leaves, etc. to add to the compost pile. (You may wish to add manure or compost starter to help get process going.)
3. Chop the materials to increase surface area and put them in the compost container (speeds decomposition process).
4. Continue to add materials. (Optimum pile size is 3' by 3'.)
5. A student should collect temperature and pH data every day. (Be sure to take temperature reading from the center of the bin.)
6. Set up graphs and record pH and temperature data daily.
7. Aerate the compost pile every 2-3 days and add water if it becomes too dry.
8. Continue this process for 14-21 days. Complete graphs and discuss.
9. Allow compost to sit for several months through the winter. Continue to aerate often and keep moist (not wet).

Building An Aerobic Compost Pile (continued)

10. Use the compost for a school project such as a flower bed or around shrubs or trees.

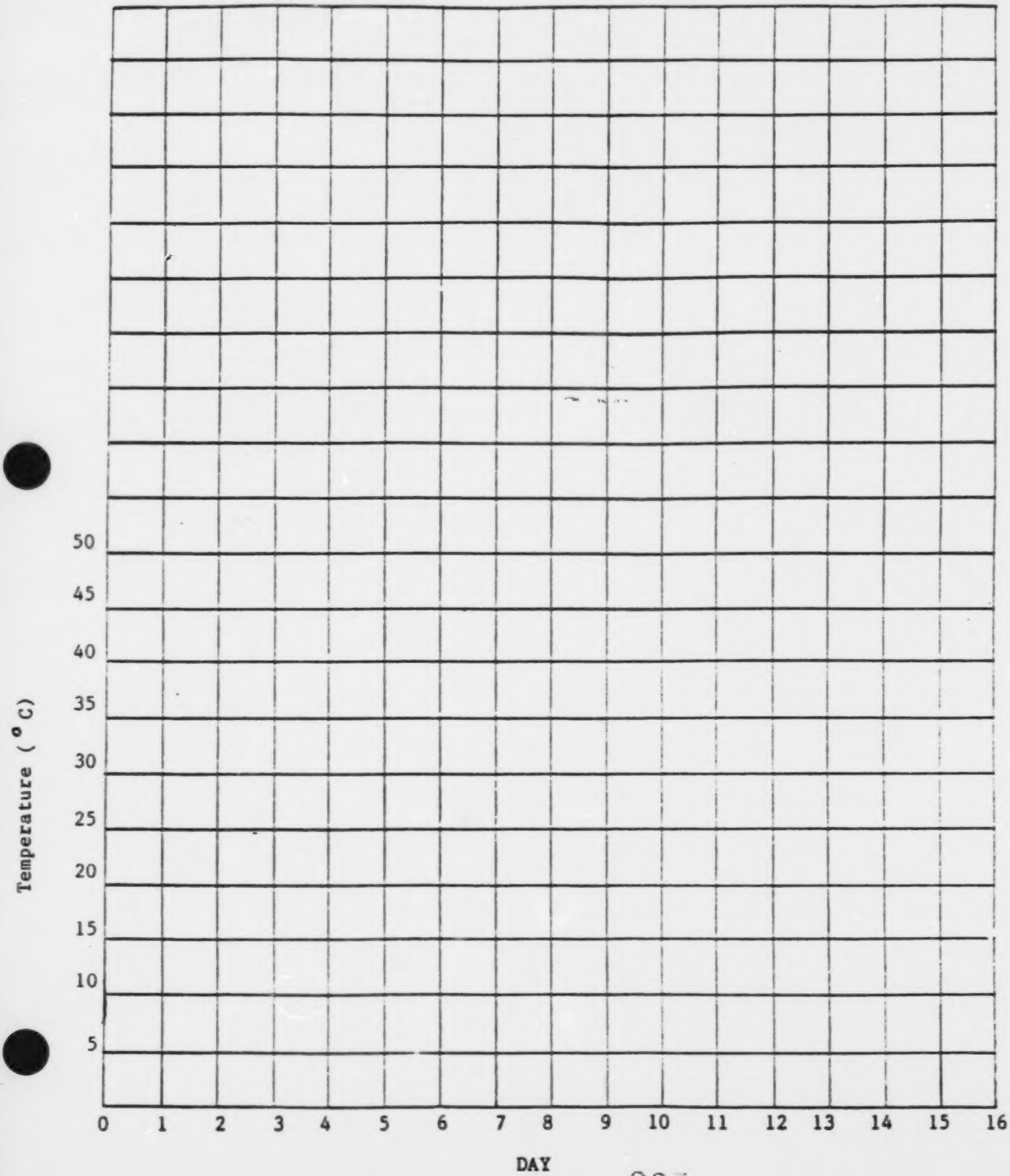
What Now?

1. Have students add the following samples to the compost pile:
   - -metals
   - -fabric swatches
   - -plastics
   - -glass
   - -cigarette filter
2. Examine these materials in the spring. Observe any decomposition that has taken place. What conclusions can you make regarding your findings?

Aerobic Compost Pile Data

NAME ____________________

DATE ____________________

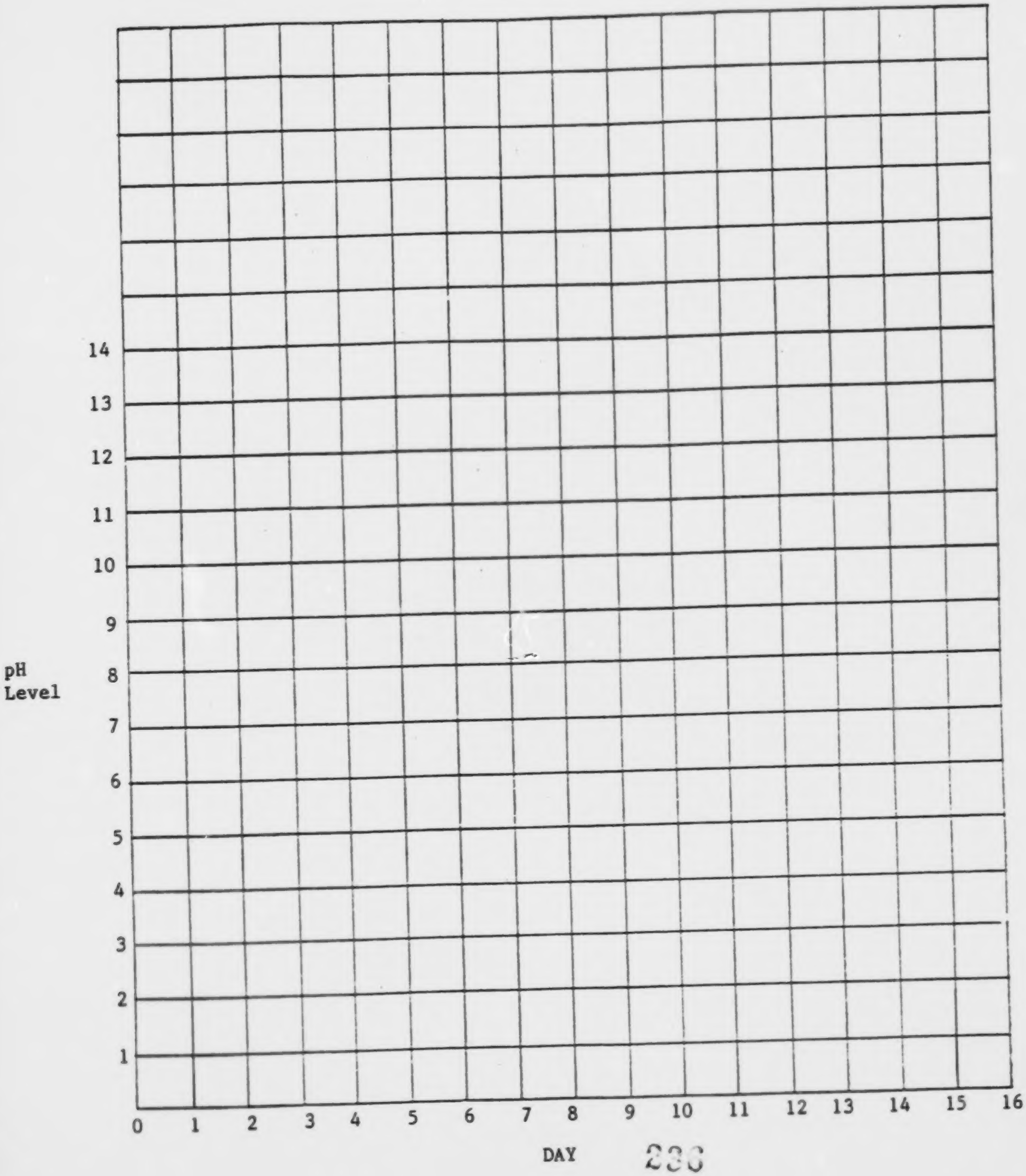


8.4

Aerobic Compost Pile Data

NAME ______________________________

DATE ______________________________



You Become The Expert

Grade Level : 8

Subject:
Communication Skills
1.0, 2.0

Time:
one-two classes

Setting:
classroom

Materials:
attached information sheets

Skills:
reading, note taking, outlining, discrimination

Vocabulary:
pulp
paper
Papyrus
cellulose
slurry
landfill
molten
bauxite
latex
pigment
sulfur dioxide

Source:
AVR Teacher's Resource Guide, Association of Vermont Recyclers

Summary: Students will read information about the history, processing, and disposal of paper, plastics, glass, and metal and report on their findings.

Objective: Student will evaluate, access, and communicate information.

Background: Students can cover a large body of information in a short period of time if taken in small amounts. Using cooperative groups and dividing materials into managable portions can be more effective than assigning every student the entire body of information. This approach allows students who are slow readers to receive maximum exposure to all the information without becoming frustrated.

Leading Question: How did plastics, rubber, metal, glass, and paper develop into their present forms?

Procedure:

1. Divide students into small groups (3-4).
2. Assign each group a topic to explore. (glass, rubber, plastics, paper)
3. Give each person in the group a copy of the attached information on that subject. (You can make one copy and cut and number it. Then give each member of the group one part.)
4. Have students read their sections while taking notes or highlighting important points.
5. When all students have completed the reading, each student (in numerical order) will share with the group.
6. Each group will prepare a written report on their topic to share with the class.

What Now?

1. Discuss the information you have covered in class with regard to reponsible use of these resources and proper disposal methods.
2. Make contact with teachers of younger students and schedule a time when the 8th graders can report to these classes and discuss the importance of recycling with those students.

The History of Paper

The first paper was made about 300 million years ago by wasps. Wasps chew wood into a pulp and use the paste to make the walls of their houses. Humans began experimenting with paper-like substances only a few thousand years ago in an effort to find a more convenient writing and drawing surface than stone.

Animal skins were cleaned and pounded and stretched to make parchment. The inner bark from trees was peeled and pounded into thin sheets, and silk, woven into fabric, was also used as a painting surface. Papyrus reeds were also layered and pounded together to form lightweight sheets.

Paper gets its name from papyrus, but the two are made quite differently, though they both contain the key element of cellulose. Cellulose is the major building block of all plant cell walls. To make papyrus, whole plants were layered and pounded together. To produce a sheet of paper, cellulose is broken down into individual fibers by beating them and mixing them with water. The water is then drained away, leaving an interwoven mass of fibers in a thin sheet.

The first real paper was probably made by the Chinese in 105 AD out of mulberry tree bark, hemp, fishnets, and rags. The first European paper mill was built in Xativa, Spain in 1151 AD. The use of linen and cotton rags for making paper became commonplace in Europe.

Paper was made by hand by dipping screens into large vats of paper pulp and drawing out and draining a thin sheet of fibers. In 1799, the Fourdrinier brothers patented a machine which produced an endless roll of paper automatically. The paper-making machinery used today is basically the same as what was developed two centuries ago.

About the same time that the Fourdriniers were developing their machine, Matthew Lyon of Fair Haven, Vermont had developed a method for making paper, not from used clothing fibers, but from the bark of the bass-wood tree and saw dust. Today most of the paper we use comes from trees, and the United States has become the largest producer and consumer of paper and paper products in the world.

From what Natural Resources is Paper made?

Wood that is unsuitable for use as lumber and lumber mill wastes are used to manufacture paper. The equivalent of 17 trees are used to produce one ton of paper. Most of this fiber comes from fir and pine forests of the northwest and pine forests of the south and southeast. Hardwood forests of the North Central U.S. and New England are also used. 3,688 pounds of wood, 28,000,000,000 BTU's of energy, 216 pounds of lime, 76 pounds of soda ash, 360 pounds of salt cake, and 24,000 gallons of water are used to make just one ton of paper.

How is Paper made Commercially from Trees?

To save transportation costs, paper mills are usually located near the forests where the wood is harvested. The trees are debarked, chipped, mixed with chemicals and processed in a large steam-heated pressure cooker called a digester. This helps to break the wood down into cellulose fibers. The fibers are then rinsed with water to remove chemicals, unwanted wood contaminants and dirt.

The remaining water-wood mixture, called slurry, is fed onto a screen and shaken to intermesh the cellulose fibers. Water is drained through the screen and the remaining sheet of paper passes through a series of rollers where it is pressed and dried. The continuous rolls of paper are produced by the machine at a rate of 30 feet per second and can be 16 feet wide.

What Effects does Paper Manufacture have on Our Environment?

About 35% of the world's annual commercial wood harvest is used to produce paper, and this share is expected to grow to 50% by the year 2000. Although wood is a renewable resource, we are presently using more of our forest resources than we are replacing. U.S. Government subsidy of lumbering activity keeps the cost of wood products artificially low, encouraging their continued depletion.

In addition to depleting natural resources, manufacturing paper pollutes the environment. According to one estimate, producing one ton of paper creates 84 pounds of air pollutants, 36 pounds of water pollutants, and 176 pounds of solid waste. Disposing of used paper pollutes again, as litter, air pollution from burning, or ground water contamination from leachate.

What do We Use Paper for?

Paper is used for three main purposes: 1) as a lightweight, durable surface for writing and printing, 2) to wrap and package food and other items, and 3) for sanitary products such as paper towels and tissue. In 1984, the United States consumed 78 million tons of paper and paperboard products. Of this amount, 43.9 million tons were thrown away, using up more landfill space than any other human-made trash.

Why Recycle Paper?

If we recycled half of the paper used in the world today we would meet almost three-quarters of the demand for new paper and as a result might arguably free ten million acres of forest from harvest destined for the paper industry. As it stands, we waste about three-quarters of our used paper resources.

According to one estimate (which likely does not assess materials transportation and processing effects), when paper is made from waste paper instead of trees, 60% less water and 70% less energy are used, and 50% less pollutants are added to the environment.

Recycling also helps extend the life of our landfills. Nearly a third of our waste stream by weight and over half by volume is made up of paper. Recycling one ton of this waste saves an average of three cubic yards of landfill space.

How is Paper Recycled?

Waste paper must be sorted prior to recycling to ensure the best quality end product and to eliminate inks and adhesives which can damage machinery. Care must also be taken to store it out of sunlight and away from water which can break down cellulose fibers and make the paper unusable.

At recycling centers, paper is baled for shipping and transported to one of over 600 paper mills in the United States. At the mill, bales of waste paper are dumped into a pulper where a rotor mixes it with warm water and breaks the cellulose fibers back down into slurry. Plastic, wax, non-water soluble glue, carbon and similar substances which have not been removed in initial sorting will clog rotor sieves.

Once the rotor has thoroughly mixed the paper-water solution, a sieve catches contaminants such as paper clips and staples. The mixture then travels on through centrifugal cleaning tanks and is bleached and deinked. Chemical de-inking can contribute to increased water pollution problems, as can loss of short paper fibers through screens.

Once cleaned, the slurry is deposited on screens, sent through rollers, and formed into the finished sheets of recycled paper in much the same way the original paper was made.

What is Recycled Paper Used for?

Waste newspaper can be shredded and re-used as animal bedding or packing material. Or it can be shredded, defibered and treated with fire-resistant chemicals for use as building insulation.

Waste paper is usually recycled into a lower grade product than the original, as wood fibers break-up and deteriorate. Hence, unlike aluminum and glass, a given quantity of wood fiber cannot be recycled perpetually. The following products are often made from recycled fibers: writing and printing paper and newsprint; roofing felt, insulation board, fiberboard, other construction materials; fruit trays, flower pots, egg cartons and other products molded from paper pulp; kraft paper, tissue, corrugated cardboard and cardboard boxes.

Is Recycled Paper as Good as Paper from Virgin Fibers?

Some people think the quality of recycled paper is not as high as paper made from virgin materials. Printers cite problems with lint from short broken fibers causing a poor quality print, and a high moisture content causing paper-feeding problems. But according to Earth Care Paper Company, recycled paper is superior to paper made from virgin fibers because the fibers are more conditioned, the paper has greater flexibility, stands up better to humidity and temperature changes, has greater opacity, holds clay better, and is easier to feed on printing presses than non-recycled papers.

A Recycling Outlook

Recycling businesses operate in a hostile economic and political environment. Paper manufacturers often make product and packaging development decisions without regard to waste disposal and environmental costs and concerns. Freight taxes are lower for virgin materials than for recycled fiber. The forest industry is heavily subsidized through government tax policies and leasing of public land below cost to loggers. These artificial structures hide the real economic and environmental costs of using virgin material.

Of the 600 paper mills in the U.S., over 200 use recycled fibers exclusively and another 300 use some recycled fibers. The U.S. has also been exporting an increasing amount to other countries: between 1970 and 1986, exports of waste paper rose from 408,000 tons to 3,749,000 tons.

Sources: American Paper Institute; RE:SOURCES, Summer 1986; Grummer, 1980; Earth Care Paper Company; State of Vermont Solid Waste Management Plan, 1988; Seymour and Girardet, 1987; Pollack, 1987; Chandler, 1984.

History of Glass

Three to four thousand years ago, Egyptians and Mesopotamians were using opaque glass as a glazing for pots and to make beads and small bottles. The technique of glass blowing produced the first transparent glass and was developed in Syria several hundred years later. The art of glassmaking spread to the Roman Empire and then throughout Europe in the following centuries, becoming a widespread and highly crafted art form. The first known established glass house in America was founded in 1739 in New Jersey. Early glass factories in America mostly produced simple useful glass objects such as window panes and bottles. The production of glass was not automated until the mid-nineteenth century.

From What Raw Materials is Glass Made?

1,330 pounds of sand, 433 pounds of soda ash, 433 pounds of limestone, 151 pounds of feldspar, and 15.2 million BTU's of energy are required to produce just one ton of glass. Major deposits of white sand suitable for making glass are found in Illinois, New Jersey, the Alleghenies, and the Mississippi valley. Most soda ash comes from Wyoming, and 65% of the feldspar in the U.S. comes from California and North Carolina.

Soda ash (sodium carbonate) and cullet (recycled glass) are added to lower the melting point of silica and to create a good consistency. Limestone (calcium carbonate) is added to stabilize the mixture and keep it from dissolving in water. Different colored glass is produced by adding small amounts of other substances such as iron, copper and cobalt. Green glass, for instance, is made by adding iron.

How are Glass Containers Made?

The entire mixture of ingredients used to make glass is called a batch. The batch is heated at temperatures reaching 2800 degrees F until the ingredients are completely melted and the mixture transparent. The batch is then cooled to about 1800 degrees F and the molten glass moved out of the furnace into a glass-forming machine which presses or blows it into its final shape.

In the glass-forming machine, compressed air pushes a gob of molten glass down into a mold. More compressed air is forced into the middle of the mold pushing the glass out against its walls. The container is then transferred to another mold where one last blast of compressed air forms the rough container into its final shape. Finally, the containers are passed through a tunnel called an annealing lehr. If glass containers cool too quickly, they may shatter; annealing prevents breakage by passing the newly-formed containers through a tunnel which reheats the glass and allows it too cool slowly.

How Much Glass do We Produce?

There are currently 90 glass bottle manufacturers in the United States making over 29 billion bottles a year. Each person in the United States uses almost 400 bottles and jars annually. However, glass production for beverage containers is decreasing as plastics become more popular. Another change is that refillable glass beer and soda bottles which were once designed to handle up to 30 round trips from manufacturer to consumer have become throwaway containers. This means that all the energy and raw materials used to produce the glass bottle are wasted, unless recycled.

We can conserve resources by reusing glass at home, and industries would save energy by cleaning and refilling bottles, although this would be partially offset by the energy required for transporting returned bottles. The next best thing after reusing glass is recycling. In 1981, only one in fifteen of the 46 billion bottles and jars produced was melted down along with fresh material to make new bottles and jars. Bottle bill legislation has recently substantially increased the amount of recycling of glass containers. In Vermont it is estimated that almost nine out of every ten glass bottles covered by the bottle bill is returned and reused or recycled.

8.10

Why Recycle Glass?

Although the raw materials from which glass is made are plentiful, their collection and transformation into glass require a large amount of energy. It takes about 7,600 BTU's of energy to produce just one pound of glass. Also created in the production of just one ton of glass are about 385 pounds of mining waste and 28 pounds of air pollutants.

Using cullet saves energy because it melts at lower temperatures. For each 10% of cullet used, the furnace temperature can be lowered 10 degrees and the batch can be up to 83% recycled glass. Using one ton of recycled glass will save 1.2 tons of raw materials. According to one estimate, by using 50% recycled glass in manufacturing new glass, water consumption can be cut in half, mining wastes cut by 79 percent and air emissions reduced by 14 percent.

How is Glass Recycled?

To prepare glass for recycling, containers should be rinsed clean of any organic waste, aluminum and plastic caps and lead wrapping removed, and separated by color. Window glass, ceramics, pyrex, lightbulbs, mirrors and other non-container glass should never be included because the different chemical compositions will cause visual inconsistencies and structural imperfections in new glass.

Once collected and separated into green, brown and clear colors, glass is broken into very small pieces called cullet. The cullet is sorted to remove remaining contaminants such as metal and plastic caps, lids and rings. Organic waste, ceramics, dirt and rocks must be removed because they can cause flaws and impurities in the new glass. It is important for recyclers to collect only clean glass, because one damaged batch may eliminate a market.

Once collected and shipped to manufacturing plants, any remaining contaminants must be removed. Cleaned cullet is added to a batch of raw materials and melted in furnaces. Any remaining paper labels are burned off at this point. Once heated, the molten glass is poured into molds to form the new bottles and jars.

In addition to new beverage containers, cullet can be used to make fiberglass insulation, concrete, polymer composite sewer pipe, brick and terrazzo. It can also be used as a filler in paving making a road surface called glassphalt.

Sources: *Oscar's Options*; Rhode Island Solid Waste Management Corporation 1985 Annual Report; *Looking Good In Ohio's Schools;* Academic American Encyclopedia; *RE:SOURCES* Summer 1986; Worldwatch Paper 76; *RE:THINKING RECYCLING*; Phoebe Philips, *The Encyclopedia of Glass;* Midwest Regional Council.

ALUMINUM

What is Aluminum?

Aluminum is a silvery white metal which constitutes 8% of the earth's crust. It is the third most common element after oxygen and silicon. It is widely dispersed through most clays and rocks, most commonly as hydrated aluminum oxide. It is never found naturally in its metallic state.

There are several characteristics which make aluminum a valuable resource. It is light, strong, and while flexible, can be made more rigid by alloying it with small amounts of other metals. Because of its affinity for oxygen, it resists corrosion by forming a protective coating of aluminum oxide when exposed to the air. Aluminum is a good conductor and insulator.

From what raw natural resources is aluminum made?

The greatest concentrations of aluminum are found in bauxite ore, where it is found as alumina in combination with oxide, titania and silica. Most of the world's bauxite reserves are located in the subtropics where heat and water weather away silica and other contaminants, leaving a higher percentage of aluminum.

Substantial bauxite deposits are located in Jamaica, Australia, Surinam, USSR, Guinea, France, Guinea, Yugoslavia, Greece, Hungary. The limited U.S. reserves are located in Arkansas, Georgia, and Alabama. The U.S. imports 85-90% of its bauxite.

How is it made into metallic form?

Surface mining of bauxite produces solid waste, energy, waterborne waste, air pollution and hazardous waste. Once taken out of the ground, it is transported to refineries around the world. It must then be refined into alumina. 55% of the world's aluminum is produced in the United States, USSR, Canada, Japan, and West Germany.

The oxygen in the alumina is separated out through electrolysis, and combined with small amounts of other metals to strengthen it. The metal is then poured into bars called billets or blocks called ingots. It is then transferred to manufacturing plants which remelt and form the aluminum into various items.

The following resources are used to produce one ton of aluminum: 8,766 pounds of bauxite, 1,020 pounds of petroleum coke, 966 pounds of soda ash, 327 pounds of pitch, 238 pounds of lime, and 197 million BTU's of energy. The pollutants created include: 3,290 pounds of red mud, 2,900 pounds of carbon dioxide, 81 pounds of air pollutants, 789 pounds of solid wastes.

What do we use it for?

Aluminum is used in packaging, building, automobile and aircraft construction. Other applications include electrical transmission, and appliances and other long-life consumer products.

Why recycle aluminum?

Recycling aluminum saves 95% of the energy required to produce it from virgin materials. Recycling an aluminum can will save the equivalent of that can half-filled with gasoline. In addition, 95% of the air pollution is eliminated, and 100% of the solid waste is diverted from landfills.

"The amount of aluminum used in cars made in the United States increased from 78 pounds per car in 1972 to 139 pounds in 1985. The Aluminum Association estimates that this figure could rise to about 200 pounds per car bby the early 1990's From 80 to 90 pecent of the truch trailers in use have aluminum bodies. Aluminum is the primary aircraft material, making up about 80 percent of the structural weight of today's jetliners."

How is aluminum recycled?

"According to Alcoa Aluminum Company, the turn around time for an aluminum can is only six weeks - from manufacturing the can, to filling it, delivering it to the store, being purchased, emptied, recycled by the consumer, shipped to a processing plant, made into cansheet, made into an aluminum can, shipped to the filler, filled, and shipped to the store." Jerry Powell.

Aluminum cans are 100% recyclable. Scrap dealers who receive aluminum from recycling centers sell recycled aluminum to smelters. The smelters must chemically analyze the aluminum they purchase, and shred and decontaminate it. Steel is removed from shredded aluminum as it passes over magnetized conveyor belts. Contamination of more than 1% non-aluminum metals makes the aluminum unusable in a smelter.

Once shredded and decontaminated, the aluminum scrap is melted for eighteen hours during which time, impurities are removed periodically. The molten metal is then poured into forms and allowed to cool. The resulting ingots are transported to manufacturing plants, remelted and formed into new products.

A Recycling Outlook

About 40% of aluminum cans are currently being recycled. Recycling rates are much higher in Bottle Bill States.

"Throughout the 1950's and 1960's, about 75 to 80 percent of all recycled aluminum was "new scrap," or industrial scrap, removed from fabrication plants. However, growing attention to environemntal protection and energy conservation in the 1970's coupled witht the enormous growth of aluminum beverage can recycling, made aluminum scrap an increasingly large proportion of the total aluminum supply. In 1984, about 30 percent of the total aluminum supply in the United States was scrap aluminum - two million net tons, 54 percent was recovered by aluminum manufacturers during fabrcation and 46 percent came from recyclers." (Phoenix Quarterly, winter 1986.)

OTHER METALS

What are iron and steel?

Iron is a naturally occuring pure chemical element. Steel is produced by adding carbon to iron. Other elements are added to this basic recipe to form different grades of steel. Steel is the most widely used metal today. After iron, the most widely used and recycled metals are aluminum, copper, zinc, and lead. Only about 30% of all metal is recycled after its first use; most of the rest eventually becomes "waste." According to World Watch Paper 23, "after five cycles, only one quarter of the metal remains in circulation. After ten cycles, less than one one-thousandth of one percent remains."

What are tin cans?

What we call "tin" cans are really steel cans with a very thin coating of tin. The tin protects the steel from corroding or rusting. Bimetal cans are tin cans with an aluminum top. They used to be common beverage containers thoughout the country. They are less expensive to make than aluminum cans, but are not easily recyclable because they are made from three metals which must be separated again for recycling. You can tell the difference between tin (steel) cans and aluminum with a magnet. Magnets will attract steel but not aluminum. Tin and bimetal cans both attract magnets.

Why recycle scrap metal?

In the last twenty years the production of steel from scrap has increased about 20% while raw steel production has declined. An increasing amount of scrap steel is being sent out of the country. Small mills which use electric furnaces to produce a specific products from scrap are called mini-mills. They bypass the initial stages of mining and processing ore and proceed directly to the fabrication of new products. By doing this they are able to save lots of energy and expense. Mining iron ore and producing steel is hard on the environment and energy-intensive. Using scrap instead of iron ore to make new steel reduces air pollution by 86% and water pollution by 76%, saves 74% of energy and 40% of the water used, and can reduce the need for virgin materials by 90%.

A Recycling Outlook

Large magnets are used to remove ferrous contaminants from aluminum scrap and to isolate ferrous scrap from mixed waste at material recovery facilities. Not very many tin cans have been recycled from Vermont; those that have have primarily found markets in detinning mills in Pennsylvania and Maryland.

The Agency of Natural Resources suggests that in the future, Canadian markets may provide a better market for ferrous scrap in Vermont. The New Hampshire Resource Recovery Association has initiated a scrap recycling program in which the heavy machinery needed to bale scrap is circulated around the state for use at different landfills. Iron is separated into categories at landfills, baled, and sent off into the night. Such large scrap iron includes white goods -- old refrigerators and stoves.

Sources: Pollack, 1987; State of Vermont Solid Waste Plan, 1988; Institute of Scrap Iron and Steel, Inc.

8.14

History of Rubber

Rubber was extracted long ago by the Mayans, and used to make waterproof shoes, clothing, bottles, and bouncing balls. It made its way to Europe with Christopher Columbus, and in the 1700's, many experiments were conducted to try to take advantage of its elastic and waterproof characteristics. The "Mackintosh" was an early attempt to waterproof coats by coating them in rubber. But a major stumbling block in the development of rubber was its intolerance for the weather extremes of Europe and North America.

In 1844, Charles Goodyear discovered a way to make rubber sturdy, longlasting and impervious to temperature extremes. He added sulfur to rubber and subjected it to heat, producing a chemical change. Goodyear discovered the process by accident and named it after Vulcan, the Roman god of fire. Because of that discovery, rubber is now used for over 50,000 different applications.

Where does rubber comes from?
Plantations in Indonesia and Malaysia produce most of the natural rubber used today. Rubber trees produce a milky liquid called latex which runs in veins beneath the outer bark. The latex contains pure rubber, water, minerals, and sugars. Trees are tapped in a way similar to the way we tap trees to produce maple syrup. One rubber tree can produce enough latex in a year to make about twelve pounds of rubber. Rubber is composed primarily of tiny particles of carbon and hydrogen held together in long twisted strings. When pulled, these strings stretch out straight giving rubber its elastic quality.

Once the latex is collected, it is strained, poured into large tanks and mixed with acid to cause the rubber particles to mass together. The masses are cut into large slabs and sent through large rolling machines where the water is squeezed out. The rubber is then pressed into bales and shipped to factories.

How is rubber made?

At the factory, the blocks of rubber are cut into smaller pieces and squeezed flat between heated drums in a milling machine. Sulfur, other chemicals, and pigments are added, and the rubber which is naturally light in color darkens. The mixture is rolled out flat and fed through an extruder to achieve the desired shape. Talcum prevents it from sticking as it is further processed. It is fed into a Vulcanizer which heats and chemically changes it, making it sturdy, longlasting and impervious to weather extremes. Finally, the talcom is cleaned off, and the rubber cut to size.

Tires

Synthetic rubber and its chemical additives are manufactured in the U.S. from oil and natural gas. Automobile tires which constitute 60% of the U.S. rubber market, are made from a blend of natural and synthetic rubbers. They also contain a reinforcing fabric made from cloth, plastic and steel and a bead of wire around the rim. This nation currently uses and disposes of some 240 million tires each year. This means an estimated one tire discarded each year for every man, woman and child in Vermont.

Tires cause disposal problems because they are not easily compacted, and unless they are shredded, they tend to float to the surface of a landfill. Stockpiles of tires breed mosquitos, spread disease, attract rodents and are fire hazards.

Rubber can be burned. The Vicon trash-burning facility in Rutland may accept up to 8% of its solid waste or 15 tons per day in tires. Because of their high carbon and hydrogen content and BTU value tires are considered alright to burn. But they produce sulfur dioxide, nitrogen oxides, heavy metals, benzene, other volatile organic compounds and particulate matter that must be carefully dealt with by the burning facility.

Other waste-to-energy incinerators in the United States are designed specifically for tire burning. One $41 million California plant built by Oxford Energy Inc. burns 4 million tires a year 24 hours a day. The plant feeds off of a 42 million tire stockpile it was built next to, and also plans to collect tires for burning at a 35 cents per tire tipping fee. Another similar plant, modelled after a plant in Germany, but 3 to 5 times larger, is proposed for Sterling, Connecticut. It is opposed by local environmental groups concerned by plant emissions.

Ten years ago, about one-fifth of the tires produced in the United States were retreaded. 45 million vehicle tires, including 31 million car tires, were retreaded. Today, this figure has dropped to about 15 million and is expected to drop to only 6 million by the year 2,000. But there are numerous advantages to retreading tires. Tire lifetimes can be up to 90 percent as long as those of new tires. According to Dennis Hayes, "if all tires were retreaded once, the demand for synthetic rubber would be cut by about one-third, tire disposal problems would be cut in half, and substantial energy savings would be realized. Jobs would be lost in the synthetic rubber and new tire industries, but new jobs would be created in the tire recapping business."

Tires can be cut into pieces and used as washers, muffler hangers, shoe soles, boat dock cushions, or doormats. Whole tires are used to build artificial reefs, floating breakwaters, and highway crash barriers. In Vermont, they are often seen as weights holding down plastic coverings on feed bunkers and are used in combination with sand as a floor base in dairy barns.

Tires can be reprocessed into devulcanized rubber or ground up and sold back to rubber companies for use in new rubber products. Eleven million tires can yield 14 million gallons of oil, 10 million pounds of steel and 63 million pounds of carbon black.

Tires can also be ground up into their component parts of rubber, fiber and metal. The resulting crumb rubber is mixed with hot asphalt and used to pave road, track and airport runway surfaces. The results from small test sections done on Interstate 89 in Springfield, Richmond and Derby, Vermont suggest that the best roadway applications for the rubber asphalt are parking lots, driveways and running tracks, where heavy traffic is avoided.

TireCycle, a new process of recycling rubber by adding it to virgin rubber, is currently operating in Minnesota and accepts tires for free. The plant produces about about 1.25 million pounds of new rubber using less than 100,000 old tires. The plant can accomodate up to 4 million tires, but needs to further develop its markets for the new product.

Sources: Hayes, 1978; White, 1983; State of Vermont Solid Waste Plan, 1988; LeBlank, 1988; Solid Waste Seminar; "Built to Last--What Can You Do With 240 Million Used Tires?" Environmental Action, March/April 1988.

8.16

How are plastics made?

The very first plastics were made from corn starch, but most plastics today are made from natural gas and crude oil. They are made by linking together small single chemical units called monomers in repetition to build one large molecule called a polymer. The plastic monomers are made from hydrogen and carbon elements in combination with small amounts of oxygen, nitrogen and other organic and inorganic compounds. When rearranged chemically, they produce a solid resin. The resins are used to make hundreds of different plastics, all of which fall into two basic categories.

THERMOPLASTICS are formed by combining the same polymer together like molecules of water. Like water, thermoplastics liquify at high temperatures and solidify when cool. This property makes it is easy to melt the plastic and reform it into new objects. Thermoplastics are used primarily for packaging.

[polyethelene (low density and high density)] margarine tubs, coffee can lids, squeeze bottles, film, pipe and tubing, plastic flowers, detergent and bleach bottles, milk and juice jugs.

[polystyrene] styrofoam, wall tile, packaging.

[polyvinyl chloride (PVC)] shower curtains, phonograph records, garment bags, raincoats, insulation.

[polypropylene] packaging, hard hats, pipes, auto parts, toys, housewears, packaging films.

THERMOSETTING PLASTICS are formed by combining different polymer molecules. Once linked together in a chemical reaction, they are impossible to separate. They cannot be melted and reformed into new shapes and so are difficult to recycle. Thermosets are widely used in furniture, toys, table ware, computer casings, and other permanent uses requiring a hard plastic. Polyester, epoxies, and melamine are all thermoset plastics.

Why is the use of plastics increasing?

Plastics currently comprise about eight percent of our solid waste stream, a share that has steadily increased since they first entered the consumer market thirty years ago. Their popularity has increased for several reasons. They are durable, lightweight, waterproof, require less secondary, protective packaging, add to consumer convenience, and are relatively inexpensive to produce. Their chemical properties can be manipulated to achieve just the right combination of properties for any application.

In what ways are plastics a problem?

Plastics are made from a non-renewable resource. Although some plastics are relatively inexpensive to manufacture, the crude oil and natural gas from which they are made comes from limited supplies, the increasingly complicated extraction of which often have serious, negative environmental and/or political impacts.

The same characteristics which make plastic an attractive packaging material also make it a special problem in the waste stream. Though lightweight, plastic is bulky and difficult to compact for shipping or for burial in landfills. Plastic will not biodegrade. Photodegradable plastics may break down into smaller pieces when exposed to enough sunlight, but will never really disappear.

Plastic litter causes particular problems in our oceans and on our beaches. Thousands of fish, sea mammals and birds have died because they have eaten or gotten tangled in discarded fishnets, six-pack rings, plastic bags and other packaging material. Virtually all our beaches and waterways are now polluted with unsightly plastic waste.

Approximately one-half of all foam packaging as of 1986 was inflated with chlorofluorocarbons. Both the manufacturing process and the packaging itself release CFCs into the atmosphere. Rigid foam products account for one-quarter of the world's use of the two most ozone-threatening CFCs. By 1990 manufacturers in the United States are now required to stop the use of CFCs; however, U.S. manufacturers account for only a small percent of CFC use worldwide.

Because they are made from fossil fuels, plastics also have a high BTU value and so can be said to be a good burning fuel. However some plastics emit toxic fumes when burned. Polyvinyl chloride, for instance, when burned, releases chlorine compounds into the atmosphere, if not controlled. These contribute to depletion of the ozone layer, a global problem receiving increasing attention. Other plastic ingredients can clog the inner workings of incinerators.

What are photo-degradable and bio-degradable plastics?

Photo-degradable plastics are plastics which have some of their chemical bonding made with compounds that disintegrate with prolonged exposure to sunlight. These plastics are being used for beverage "six-pack" rings, shopping bags, and in some commercial agricultural applications (drying trays for raisins). They do deteriorate into smaller pieces of plastic, but do not in fact decompose.

True bio-degradable plastics, plastics that disintegrate into organic substances as the result of natural processes, are largely experimental and have not come into wide use because of their relative high cost. "Biodegradable plastics are made by fermentation of natural substances such as sugar and other carbohydrates. One firm has produced biodegradable plastic with the help of a vigorous strain of bacteria found in canals. The bacteria are cultivated in vats and fed a sugary diet on which they thrive. In doing so they multiply and produce biological "plastic" rather like mammals make fat in their bodies as they grow. The plastic is extracted in fermentation vessels, and is then dried and sold as granules. This plastic is readily broken down by algae, fungi, or bacteria in the soil. A bag made from it will disappear within twelve or fifteen months or indeed within only three of four months if it is placed in a compost heap." (Seymour, 1987)

Recently the "bio-degradable" label has been used for a number of plastics (particularly shopping bags) that use cornstarch or other organic substances as bonding agents in or in combination with crude-oil plastics. Like photo-degradable plastics, these plastics do deteriorate as their organic matter decomposes, but they in fact degrade into smaller pieces of plastic which do not bio-degrade.

How are plastics recycled?

Plastics must first be sorted by resin type. They can then be baled or shredded for transportation to a remanufacturing plant. Thermoplastics are easily recycled by melting and reforming them into new shapes.

Because plastic molecules migrate and can be contaminated with food particles, recycled plastic cannot be used for food containers. They are used as a filler layer in food packaging as long as they don't come into direct contact with the food. The quality of recycled plastic depends on how well the scrap is separated prior to recycling. The less control over this process, the poorer quality product results.

Polyethelene terephalate (PET) soda bottles are shredded into fibers and woven back into threads to make clothing or used to stuff sleeping bags, quilts, and parkas.

Plastic milk jugs, juice jugs, bleach bottles and detergent bottles are made of high density polyethelene (HDPE). They are commonly recycled into construction materials such as railroad ties, parking blocks, piping, and beams can be made from recycled plastic.

8.18

Why are plastics hard to recycle?

There are hundreds of different kinds of plastics, more than 46 of which are in common use. Each type has a different chemical composition and is carefully engineered for a specific purpose. Layers of different plastics can be used in just one container, each adding a special quality to the design. By sight, these chemical recipes are indistinguishable.

The success of plastics recycling depends in part on the proper identification and separation of plastics. PET soda bottles and milk and cider jugs as well as detergent and waste oil containers are beginning to find markets for recycling because they are made from one kind of plastic and are easily identifiable. But recycling for other plastic films, food containers, lids, wraps, tapes, etc. is still not feasible. The Society of Plastics Industry has recently developed a voluntary coding system so that plastics can be easily identified and separated by sight and this may facilitate recycling. Research is also being done on melding unsorted plastics into a composite material, primarily envisioned for use as a building material.

Transporting plastics for recycling is expensive because they are lightweight and bulky. While secondary plastics are commanding high prices now, the cost of transporting a ton of plastic is much greater than any other recycled material. The sale price of the material is quickly eaten up by the costs of getting it to market.

Sources: Pollack, 1987; Pess, 1985; Oregon DEQ.

(See also State of Vermont Household Hazardous Waste chart)

What is Household Hazardous Waste (HHW)?

A hazardous waste is a discarded substance whose chemical or biological nature makes it potentially dangerous to people or wildlife. Our homes contain many hazardous substances, and pose a threat to our health if they are not used, stored, and disposed of properly. Haphazard disposal of hazardous waste hurts our environment whether it comes from industry or homes.

Why are wastes hazardous?

Wastes are considered hazardous due to the way they affect humans or react with other chemicals. They are usually grouped into the following five categories: caustic, if they destroy living tissue; explosive, if they react violently with exposure to other chemicals or heat; infectious, if they can cause or transmit disease; toxic, if they are poisonous; or radioactive, if they give off radioactive particles.

What are some examples of HHW?

HHWs include pesticides, auto fluids, both car and household batteries, drain cleaners, solvents, paints, and varnishes and many other products which will pollute the liquid (sewage) and solid waste streams. The majority of HHWs come from maintenance items around the house. By weight paints and varnishes discarded in landfills constitute about 50% of the problem; household batteries (high in mercury) are the second biggest problem.

How much do we have in our homes?

Almost every American home is a hazardous waste generator. It is estimated that the average home stores between three and ten gallons of such waste. The Environmental Protection Agency estimates that over one million tons of HHW are produced in the United States each year, the use averaging out to 21 pounds or 25 gallons per person per year.

What are the problems associated with HHW?

Although HHWs contribute to less than 1% of the municipal waste stream, they still have great potential to pollute the environment through improper disposal in landfills, down drains, and by onsite disposal (e.g. pouring waste oil on the road) and illegal dumping. Disposal of HHW in a landfill makes its leachate hazardous and threatens groundwater, and disposal in septic and municipal sewage systems taxes municipal wastewater treatment facilities and may make disposal of their sludge difficult. Although we are speaking of relatively small quantities, parts per million or even parts per billion of some substances will render a water supply undrinkable and dangerous to humans and other life. Many chemicals can produce such an effect after accumulation of minute amounts over many years.

The impact of low level, long-term exposure to many chemicals present in our homes and the environment is still unknown; however, children, the elderly, and adults with asthma and allergies are known to be most susceptible to any effects. Some researchers warn that very brief exposures to some substances found in many household products may be all that is needed to cause irreversible harm to ourselves and the environment.

Making Paper

Grade Level : 8

Subject:
Science 2.1, 2.5, 2.12, 4.3, 5.1, 6.2, 6.6

Time:
two to three class periods

Setting:
classroom

Materials:
two equal sized picture frames for each group of four students, screen, blender, stapler, newspaper, white construction paper, sponge, large plastic pan

Skills:
communication, observation, formulating models, scientific inquiry

Vocabulary:
pulp
recycle

Source:
Watauga County Recycling Curriculum Committee

Summary: This activity leads students through the process of creating a recycled product from material that might otherwise be discarded.

Objective: Students will observe the production of a recycled paper product and understand the advantages of this process.

Background: Each year, millions of acres of wooded land are stripped and the wood used to produce paper. Tons of paper are discarded daily from our homes, offices, and schools. We can prevent this waste of natural resources by saving used paper products for recycling.

Leading Question: How can used paper products be processed for reuse?

Procedure:

1. Staple the screen to one side of the frame. Place the other frame on top of the screen.
2. Shred the newspaper (two sheets for each group of 4 students) into small pieces and place in the blender with 1 liter of warm water.
3. Blend this mixture until it is well mixed into a fine pulp. Pour into plastic pan.
4. Holding the two frames together, dip them into the mixture and lift them straight up out of the water.
5. Let the water drain through the screen.
6. Remove the unscreened frame, (it should be on top) and blot first with construction paper and then with the sponge.
7. Cover the pulp with construction paper and turn it over so that the pulp is on the paper. Let dry overnight.
8. Complete the worksheet entitled "Paper Making Worksheet"

Paper Making Worksheet

1. Record the following observation you made during the paper making process:
   -Color of water used to make pulp
   -Time required to produce pulp in the blender
   -Texture of "new" paper
   -Other observations

Making Paper (continued)

2. What was the mass of the paper you used?

3. What was the mass of "new" paper?

4. What was the difference in mass if any?

5. How do you account for the difference if there was any?

What Now?

1. Do a research paper on the paper-making process and its effect on the environment.

2. Design a bulletin board promoting awareness of the importance of paper recycling.

3. Have a poster contest showing the effects of wasting our natural resources.

4. Write an essay entitled, "What Can I Do To Save Our Forests?"

5. Use the "new" paper to make birthday cards for students.

PAPER MAKING WORKSHEET

1. Record the following observations you made during the paper making process:

   - Color of the water used to make pulp ______________________________

   - Time required to produce pulp in the blender ______________________________

   - Texture of "new" paper ______________________________

   - Other observations ______________________________

   ____

2. What was the mass of the paper you used? ______________________________

3. What was the mass of the "new" paper? ______________________________

4. What was the difference in mass, if any? ______________________________

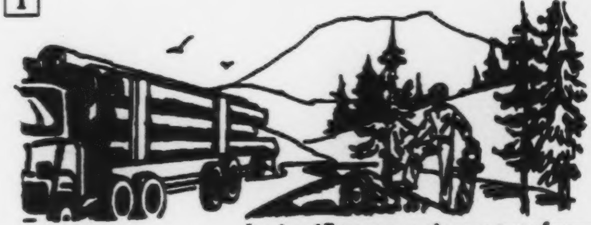
5. How do you account for the difference, if there was one? ______________________________

   ____

   ____

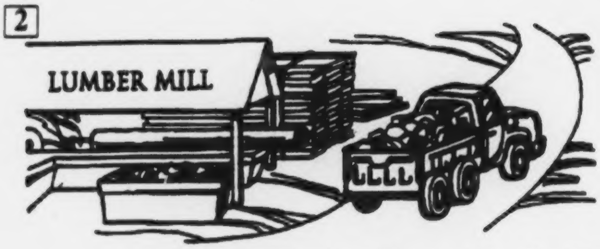
Making Paper

1



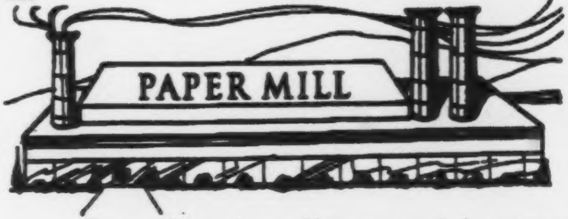
It takes 17 trees to make one ton of paper.

2



Wood wastes from lumber mills are used to make paper.

3

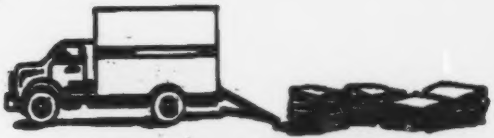


Paper mills turn the wood into paper ready for you to use.

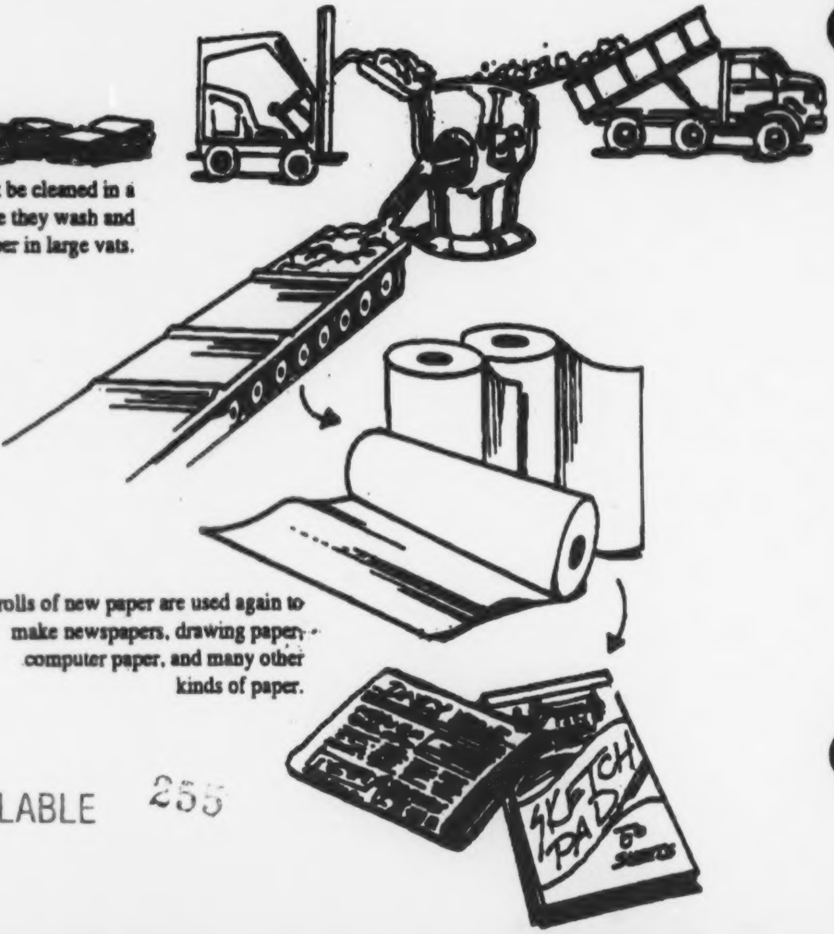
4

Once paper is used, it should be sent to be recycled, not thrown away.

5



Old paper, like newsprint, must be cleaned in a processing called "de-inking" where they wash and rinse the paper in large vats.



Sometimes newsprint and wood wastes are combined, mixed into a pulp and poured onto large rollers. Other times mostly used paper is processed again.

6

The rolls of new paper are used again to make newspapers, drawing paper, computer paper, and many other kinds of paper.

BEST COPY AVAILABLE

Taking A Closer Look At School Trash

Grade Level : 8

Subjects:
Science 2.2, 2.4, 2.5, 2.9, 4.2
Communication skills 1.3, 2.1, 2.2, 3.1
Math 5.5, 6.5

Time:
three class periods

Setting:
classroom, other areas of the school where materials are being used that can be recycled

Materials:
balance, trash container, large container to hold trash on the balance

Skills:
research, graphing, measuring, communication

Vocabulary:
pollution
conservation
biodegradable
groundwater

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will form research teams to investigate the way recyclable materials are used and disposed of in the school.

Background: Schools use many products that are recyclable. Most of these end up in the landfill unless your school has a plan to collect these items and deliver them to a center to be recycled.

Objective: Students will investigate the waste production of the school and devise a plan to improve recycling habits.

Leading Question: What do we throw away at our school, and could we recycle more of it?

Procedure:

1. Generate a list of materials that the school uses that can be recycled from a general class discussion/brainstorming session.

2. Read and discuss the "Watauga County Sanitation Solid Waste Analysis" (see "Where Does It All Come From") or a similar report from you county or city.

3. Have students form research teams with 4-5 members.

4. Using the "North Carolina Sanitation Solid Waste Analysis" sheet (see "Where Does it All Come From" activity), have the groups write a narrative describing the information found in this report. Inform the groups that they will be writing a similar report on their school solid waste data.

5. Assign each research team one of the following school areas from which to gather data:
   a. Cafeteria
   b. Library
   c. Classrooms (Two groups might divide these up)
   d. Office
   e. Gym/Playground

6. Complete the attached worksheet using data you have collected.

7. Combine the information from all groups and complete the attached bar graph. Create a school analysis report similar to the Watauga County Sanitation Solid Waste Analysis or similar report from your county or city solid waste management office.

Taking A Closer Look At School Trash Worksheet

ASSIGNED AREA:

GROUP MEMBER NAMES: ______________________________

1. Collect all the material being thrown away in your assigned area of the school.

2. List the different types of materials you found.

3. List those materials you found that could be recycled and record the mass of each below.

4. Ask the person in charge of your assigned area the following questions:
    a. Are any of the solid waste items from this area recycled? If so, what are they and approximately what percentage is recycled?
    b. Is the amount of trash we found today about the same as you have every day? If not, how is it different - more, less, etc.?
    c. Would you be willing to participate in a school-wide recycling program if one were initiated?
    d. Are there more durable or bulk items that could be purchased to reduce the amount of waste created for recycling or disposal?
    e. Could discarded items be repaired or reused?

material	mass (g)

Creating Something Out Of Nothing

Grade Level : 8

Subject:
The Arts 2.4, 3.0

Time:
two to three classes

Setting:
classroom

Materials:
assorted art supplies, e.g. glue, poster paper, markers, etc.
solid waste material chosen and supplied by each student

Skills:
art - design, evaluation, fine art processes

Vocabulary:
sculpture
collage
solid waste
recycle

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will choose a solid waste material that would otherwise be thrown away and create a piece of original art.

Objective: To broaden the scope of artistic media and to increase and develop an awareness of the need to reuse our natural resources.

Background: Every day we throw away tons of materials that could be reused to create artwork and other usable items. Allowing students to be involved in the process of building valuable items from waste can promote habits that will last a lifetime.

Leading Question: Can students plan and build a piece of art from discarded items?

Procedure:

1. Discuss the importance of reducing, reusing, and recycling our natural resources.
2. Brainstorm ways solid waste materials might be reused creatively.
3. Assign students the task of choosing a product that would otherwise be thrown away and creating a piece of art from this.
4. Students should write a description of their artwork and include a sketch of the final product.
5. Spend 2-3 class periods building the artwork.
6. Display the work in a central area. Certificates and ribbons might be given for exceptional work.

What Now?

1. Encourage students to continue to create various types of art using these media. Put the outstanding artwork on permanent display in the school.
2. Put together a pamphlet of ideas as a reference for future classes.

A Penny Saved

Grade Level : 8

Subjects:
Science 3.5
Math 1.0

Time:
two class periods plus one week of collecting data

Setting:
classroom, home

Materials:
survey chart

Skills:
math - ability to recognize and solve problems
science - ability to understand the relationships between man and the environment

Vocabulary:
environment
wood pulp

Source:
Watauga County Recycling Curriculum Committee

Summary: Students will gather data in order to determine how much money a family can save by recycling.

Objective: To increase students' awareness of the economic advantages of recycling.

Background: For every can you recycle, you are saving as much gasoline as would half-fill the same can. It is estimated that for every 25 aluminum cans you recycle, you are saving a gallon of gasoline.

Leading Question: How much can your family save in one year by recycling aluminum cans and glass bottles?

Procedure:

1. Count up the number of cans your family uses or estimate to the best of your ability. Include all cans used at home, work, and during school.
2. Divide the number you found in Step 1 by 25. This is how many gallons of gasoline your family could save in one week. How many gallons could you save in one year?
3. Call your local scrap metal dealer or Reynolds Aluminum Recycling (Eastern NC (800) 835-5479) Western NC (800)-854-7260 for the current market price of aluminum cans.
4. Weigh your aluminum cans to find how many cans are in one pound (approximately 29). Multiply the market price by the number of pounds of cans you have. Calculate the recycling revenues for one year.

What Now?

1. Have each student find out the price of gasoline paid by their parents the last time they bought gas. Compute the average price for a gallon of gasoline and have students find the amount of money they could have saved by recycling their aluminum. How could this money be used? What kinds of things could students buy with the money that would promote environmental awareness?

8.28

A Penny Saved (Continued)

Survey Chart

Day	# Aluminum Cans
Monday	
Tuesday	
Wednesday	
Thursday	
Friday	
Saturday	
Sunday	
Total	

NATURAL RESOURCES

Reducing Waste In The Home Environment

Grade Level : 8

Subjects:
Science 2.3, 2.4, 4.2, 5.1
Math 5.5, 6.5

Time:
two class periods

Setting:
classroom, home

Materials:
Home Survey Worksheet, set of pictures included with this activity, markers, poster board

Skills:
collecting and interpreting data, communicating data on graphs

Vocabulary:
natural resource
hazardous waste

Source:
Watauga County Recycling Curriculum Committee

Summary: This activity involves students in a discussion of the use of natural resources in the home. Students will conduct a home survey to evaluate energy and water use, and solid waste and hazardous waste disposal by their families.

Objective: Students will define natural resources, identify their origins, collect data in a survey, and communicate the results in a graph. Students will also devise strategies to use natural resources more efficiently.

Background: If the Earth were only a few feet in diameter, floating a few feet above a field somewhere, people would come from everywhere to marvel at it. People would walk around it, marvelling at its big pools of water, its little pools and the water flowing between the pools. People would marvel at the bumps on it, and the holes in it, and they would marvel at the very thin layer of gas surrounding it and the water suspended in the gas. The people would marvel at all the creatures walking around the surface of the ball and at the creatures in the water. The people would declare it as sacred because it was the only one, and they would protect it so that it would not be hurt. The ball would be the greatest wonder known, and people would come to pray to it, to be healed, to gain knowledge, to know beauty and to wonder how it could be. People would love it and defend it because they would somehow know that their lives, their own roundness, could be nothing without it. If the Earth were only a few feet in diameter.

-Friends of the Earth, New Zealand

Leading Question: How can we identify and reduce the use of our natural resources at home?

Procedure:

1. Display pictures of a light bulb, water, and automobile.
   -What natural resources are represented by the pictures?
   -What is the source of each natural resource?
   -What is the environmental impact of using each resource?

2. Distribute home survey sheet to students, and direct them to complete these.

3. Encourage students to involve family members in this activity.

4. Discuss the results of the survey, then construct graphs plotting the class data.

5. Our population is increasing at an alarming rate. In 1818, the population was 1 billion. In the next 100 years, that number had doubled. By 1974, the population had doubled again to 4 billion.

Reducing Waste In The Home Environment (continued)

At this rate, it will double again in only 39 years. Assuming your class is growing at the same rate, complete the following activities:

a. How many students are there in your class?
b. What would the population of your class be by the year 2029 if it grows at 1.8% annually? (Multiply class size by 1.018, 39 times)
c. Discuss how population growth can have an impact on the environment.

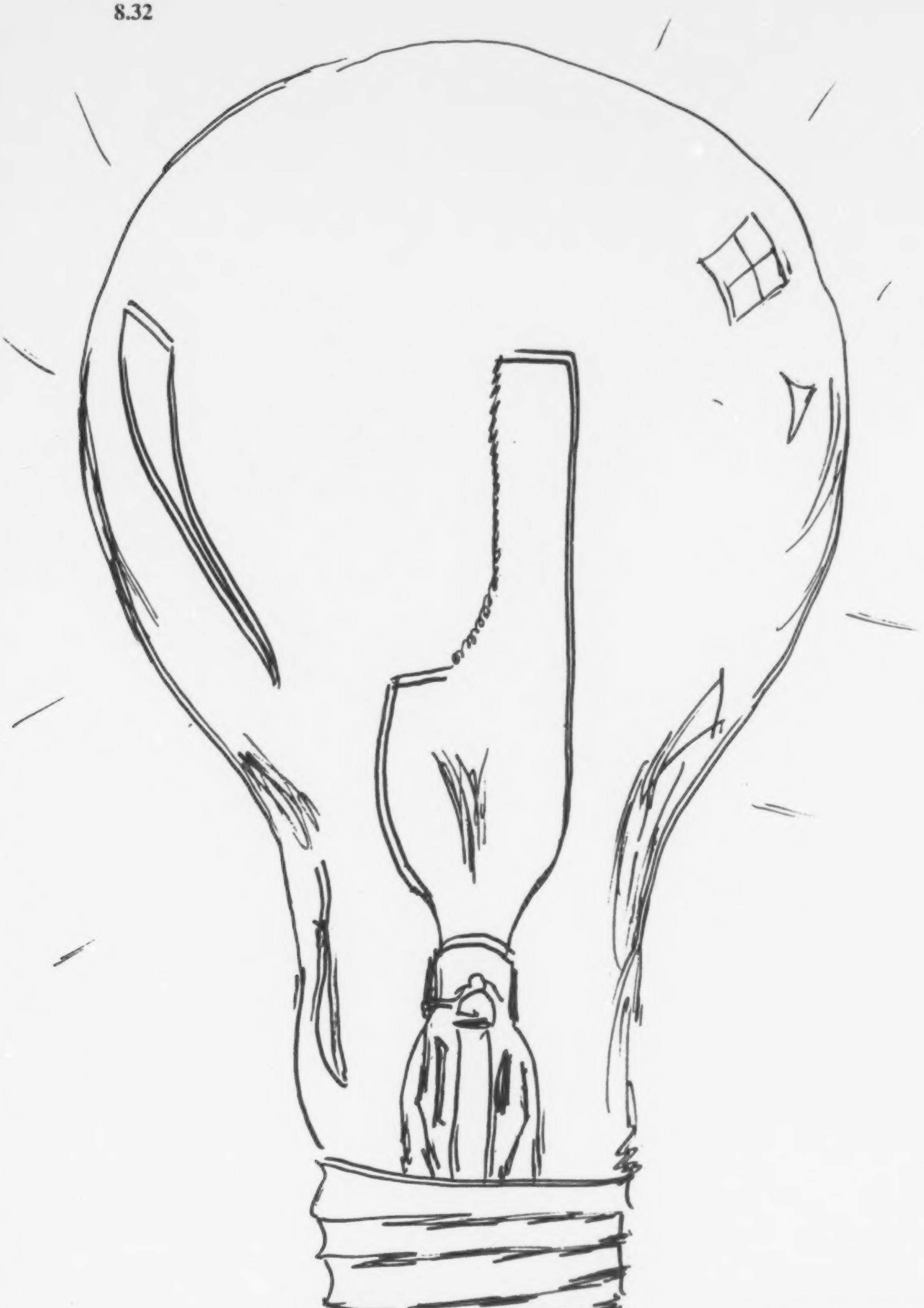
What Now?

1. Read and report on the book *SILENT SPRING* by Rachel Carson.
2. Interview senior citizens about each issue area. (Energy, water, recycling, and toxins) Report your findings to the class.
3. Compile information on how natural resources are being used and depleted in the world.

Home Survey Worksheet

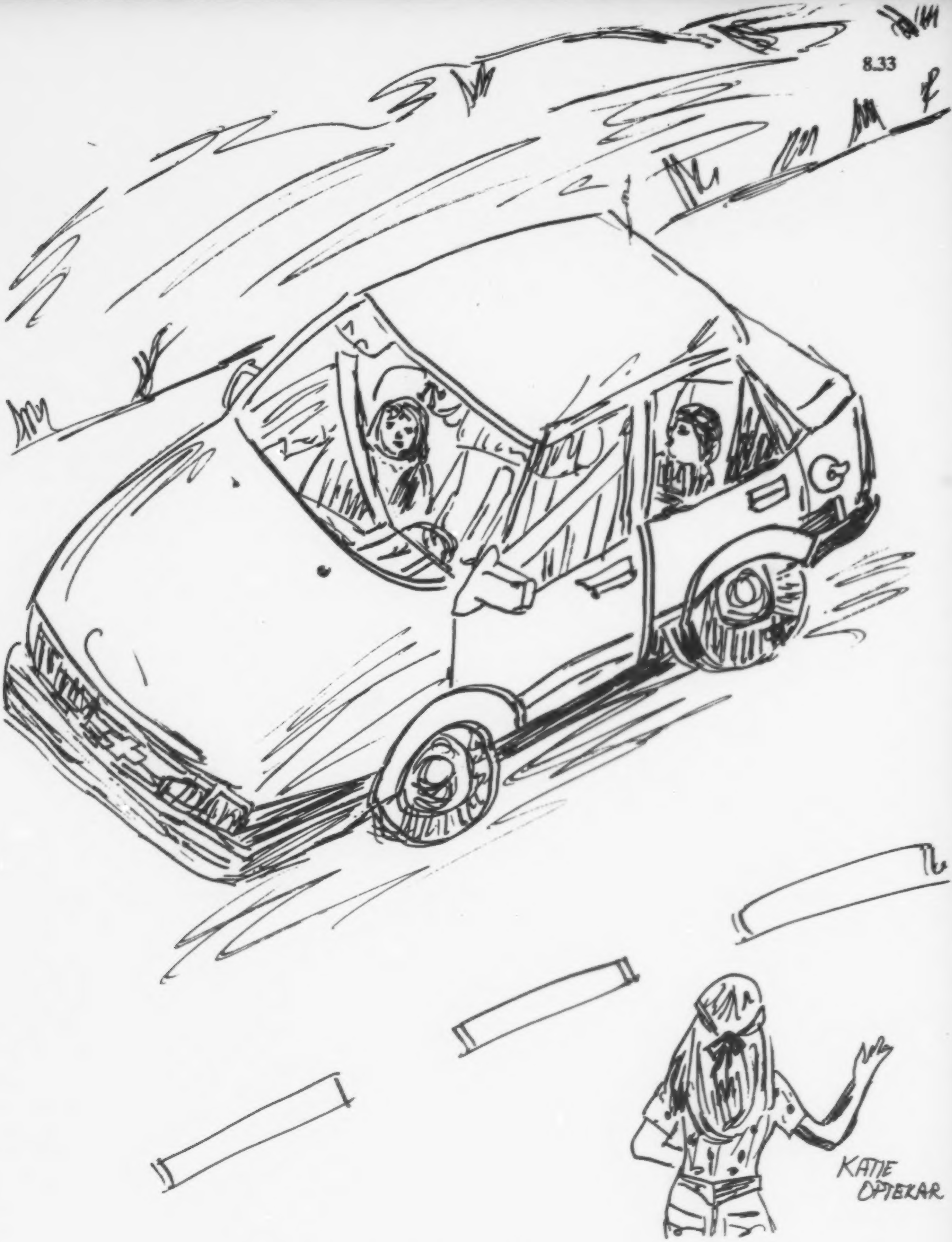
Find the following information about your family's use of natural resources.

1. How many gallons of gasoline does your family use per week?
2. How many miles does your family drive in a typical week?
3. Calculate the number of miles per gallon your automobile burns.
4. How much does your family pay for a gallon of gas?
5. Calculate the cost of gas per week, per month, and per year.
6. How much does your power company charge per kilowatt hour?
7. Examine your cabinets where cleansers and medicines are kept. Make a list of potentially hazardous materials you find there.
8. List the items your family recycles each week. Estimate the amount of each material.
9. Look for items you throw away that could be recycled. List these.
10. Plan a strategy to help your family save enough money to go on a vacation from energy conservation and recycling.



KATIE OPTEKAR
8th GRADE
PARKWAY

8.33



KATIE OPTEKAR

8.34

KATIE OPTEKAR
8th GRADE

Where Does It All Come From?

Grade Level : 8

Subject:
Science 4.2, 5.1, 6.6

Time:
several days

Setting:
classroom

Materials:
worksheet and chart

Skills:
research

Vocabulary:
solid waste
environmental management
incinerator

Source:
AVR Teacher's Resource Guide
Association of Vermont Recyclers

Summary: This activity leads students through a search to find the major sources of solid waste materials.

Objective: Students will identify the sources of waste in our society and devise ways to reduce the amount of this waste.

Background: In 1993-94, the residents of North Carolina disposed of 7,256,805.18 tons of solid waste. Although nationally we have increased our rate of recycling by 43% since 1990, it is imperative that we continue to increase recycling and reduction efforts to protect our natural resources. In North Carolina, commercial and industrial waste make up two-thirds of the material disposed.

Leading Question: How much solid waste is being produced in our community and what are the major sources?

Procedure:

1. Review the attached chart with the class.

2. Form cooperative learning groups of 4-5 students and assign each one of the following research topics:
   -Furniture Manufacturing in North Carolina
   -Textile Industries of North Carolina
   -The Impact of Tourism on the North Carolina Environment
   -Local Industries and Their Environmental Impact
   -Watauga County Solid Waste Analysis - Where Does It All Come From? (Contact your local waste management office for your county's or city's statistics.)

3. Use the worksheet to help you compile information for your research report.

What Now?

1. Make a list of waste reduction strategies for a local business.

2. Create a new product using the waste products from a local business.

3. Do a home waste survey with your classmates and estimate the annual totals. Discuss strategies to reduce and recycle this material.

4. Contact your local waste management office to find out how much of your local wastestream is residential, commercial, and industrial. Prepare a graph to represent these percentages.

8.36

Where Does It All Come From? (continued)

Research Worksheet

Names ______________________________

Research Topic ______________________________

Date ____________________

Find answers to all the following questions that apply to your research project:

1. What are the names of the businesses or institutions you plan to contact and their phone numbers?

Business	Phone Number

2. Who are the contact persons with whom you have spoken?

Business	Contact Person

3. What questions do you plan to ask in order to compile the information you will need to complete your research project? Be sure every person in the group helps develop these questions.

QUESTIONS:

ANSWERS:

Watauga County Sanitation Solid Waste Analysis

July 1, 1992 to June 30, 1993

Weights:	
Tonnage weighed:	**35,208.01**
Tons/day (5.5 days/wk	**124.28**
Pounds per capita:	**1905.6**

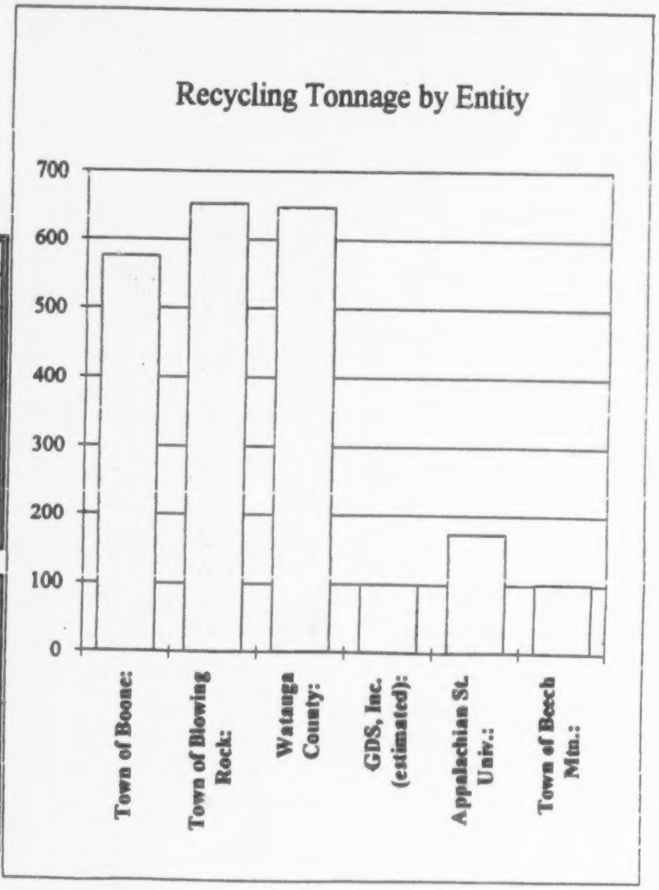
Waste Type:	
Municipal solid waste:	**79.20%**
Demolition debris:	**19.10%**
Metals & appliances:	**1.04%**
Tires:	**0.66%**
Total:	100%

Waste Percentages by Customer:	
Town of Boone	**28.60%**
GDS, Inc.	**15.37%**
County container site systems:	**24.79%**
Commercial waste (landfill):	**11.65%**
Private waste (brought to landfill):	**7.54%**
Town of Blowing Rock:	**6.60%**
Appalachian State University:	**5.45%**
Total:	100%

Waste Reduction:

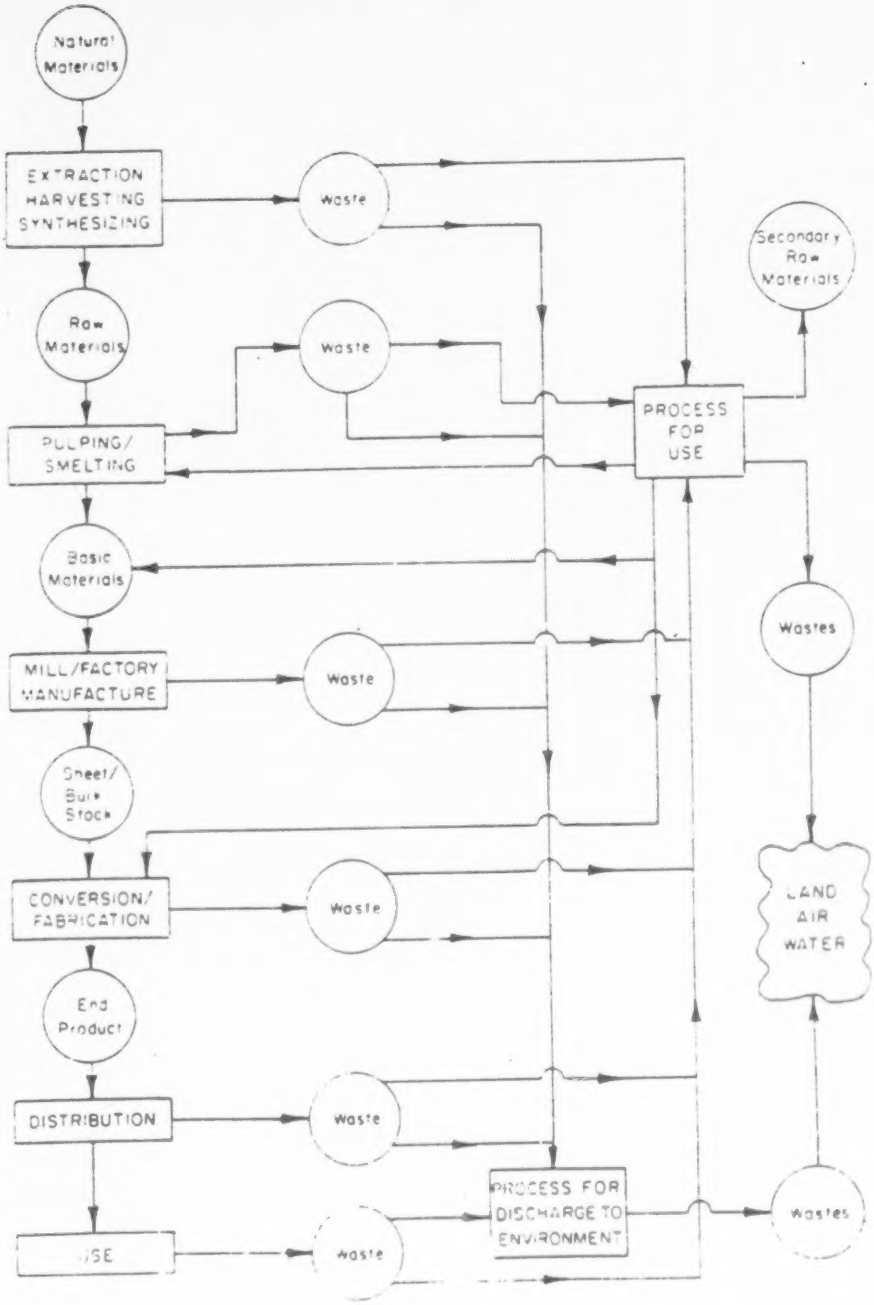
Recycling Programs:	tons	%
Town of Boone:	**575.47**	**5.7**
Town of Blowing Rock:	**651.98**	**28**
Watauga County:	**646.63**	**7.4**
GDS, Inc. (estimated):	**100**	**n/a**
Appalachian St. Univ.:	**173.89**	**9**
Town of Beech Mtn.:	**102.28**	**n/a**
TOTAL TONS RECYCLED:	**2250.25**	

Integrated Systems:	tons	%
Demolition debris:	**6717.82**	**19.10%**
Tires (to Concord):	**233.27**	**0.66%**
Metals & appliances:	**367.74**	**n/a**
Landfill savings (baler):		**37%**
RECYCLING RATE:		**6.39%**
TOTAL REDUCTION:		**63.15%**



8.38

SOURCES OF WASTES IN A SOCIETY


Natural Materials
EXTRACTION HARVESTING SYNTHESIZING
Waste
Secondary Raw Materials
Raw Materials
Waste
PROCESS FOR USE
PULPING/ SMELTING
Basic Materials
Wastes
MILL/FACTORY MANUFACTURE
Waste
Sheet/ Bulk Stock
CONVERSION/ FABRICATION
Waste
LAND AIR WATER
End Product
DISTRIBUTION
Waste
PROCESS FOR DISCHARGE TO ENVIRONMENT
Wastes
USE
Waste

Junk Mail Connection

Grade Level : 8

Subject:
Science 6.5, 6.6

Time:
one week

Setting:
classroom
home

Materials:
none

Skills:
measuring, oral communication, written communication

Vocabulary:
consumer
rain forest
agriculture

Source:
Watauga County
Recycling Curriculum
Committee

Summary: Students will collect and weigh all junk mail received at home for a week.

Objective: To make students aware of how much waste there is in the production and mailing of advertisements and other types of junk mail or unwanted mail.

Background: Our forests are being depleted at an alarming rate. Land is being cleared for cattle raising, for agriculture, and for consumer products. Humans are responsible for starting 90% of all forest fires. One place we can personally take action to reduce waste is to reduce the amount of unwanted mail we receive.

Leading Question: How much of the mail received in our homes is necessary and how can we stop the junk mail explosion?

Procedure:

1. Hand out the fact sheet on the use of forests.
2. Read these together and discuss the misuse of this natural resource.
3. Explain that paper is made from trees and that it is a natural resource. Have students identify sources of paper waste in our society. If they do not think of it, mention junk mail.
4. Have students bring in all junk mail collected from their homes in a 5 day period.
5. Fill out the information on the attached data chart.
6. Brainstorm ideas for reducing junk mail. Among these might be:
   - contact post office and ask if you can request no more junk mail. [The U.S. Postal Service refers to junk mail as bulk business mail (BBM).]
   - return all envelopes that are postage paid to companies with a note requesting your name be removed from their mailing.
   - contact direct mail organizations directly to ask that your name be removed from their mailing lists.

What Now?

1. Have students calculate the number of trees that are used to produce the junk mail that comes to all students' homes during the course of a year. One ton of junk mail uses up to 17 trees. (One ton equals 2,000 pounds.) Plan to replant these trees around the school.

2. Start a "Junk Mail Termination" campaign in your school or community to help others reduce the amount of junk mail they receive. (See Appendix for more information.)

Junk Mail Connection (continued)

FACT SHEET
for
JUNK MAIL CONNECTION

- Five square meters of forest must be sacrificed to produce one hamburger.

- At least 15 percent of land that was formerly rain forest is now devoted to raising coca for cocaine.

- About 90 percent of forest fires are started by people.

- Lumber interests in the American Northwest claim that saving the habitat for the endangered spotted owl will cost 20,000 jobs.

- Contrary to popular belief, the soil in the rain forest is very poor because most nutrients are tied up in the plant matter.

- Deforestation of rain forests leads to erosion as the plants are no longer available to hold soil in place.

- At least 50 percent of the rain forest has been destroyed since 1950.

- 14.7 million acres of land are becoming desert-like each year.

- About 17 trees are required to produce one ton of paper.

DATA CHART

Junk Mail Connection

Class: ________________________________

Student Name: ____

DAY	# PIECES	MASS	# STUDENTS PARTICIPATING
1.			
2.			
3.			
4.			
5.			

How many people at your home receive junk mail? ________________________

What is the class total for the week? ________________________

How much mass would be accumulated in one year by your class? ________________________

If one ton of mail accounted for 17 trees, how many trees were used to produce all the junk mail for your class for one year? ________________________

Does the amount of junk mail vary during the year (i.e. July vs. December)? ____________________

PACKAGING

What's In That Package?

Grade Level : 8

Subjects:
Science 2.1 - 2.14
Math 2.4

Time:
one class period

Setting:
classroom

Materials:
graph paper, attached sheet

Skills:
science - inferring, organic chemistry, interpreting data
math - graphing

Vocabulary:
biodegradable
toxic

Source:
Watauga County
Recycling Curriculum
Committee

Summary: Students will investigate the various types of packaging and learn which are the most environmentally friendly.

Objective: Students will be able to evaluate the environmental impact of different packaging types and communicate data on a graph.

Background: Plastics currently being used to package our beverages are not biodegradable. Some plastic resins are more marketable than others.

Leading Question: How have beverage containers changed over the years?

Procedure:

1. Give students a copy of "The Choice is Clear" worksheet.
2. Discuss the background information and the facts in the table with class.
3. Set up a graph or series of graphs communicating this data.

What Now?

1. Discuss with the class the implications of their findings. What are the implications if the trend toward the use of disposable containers continues? Have students develop a survey to find how many homes represented by your class use products packaged in recyclable materials or refillable containers.

8.43

What's In That Package? (Continued)

The Choice Is Clear

Your parents and grandparents may well remember when milk and soda came in glass bottles. The empty bottles were returned to the store. When the store collected enough bottles, they were trucked back to the bottling company. Sterilization guaranteed there would be no germs left on the bottles. Then each bottle was refilled and sent back to the store. Some bottles made this trip as many as 20 times. When the bottle broke or became too badly scratched, the glass was melted down and reformed.

In the 1970's things began to change. Milk started appearing on grocery store shelves in wax cartons and plastic jugs. The soda industry switched to plastic containers. Businesses made these choices based on cost and other factors. Any packaging choice should consider a life-cycle analysis.

Container Costs For 1000 Gallons of Soda

	Glass	Glass	Aluminum	Plastic	Steel
Times used	19x	1x	1x	1x	1x
Energy (10 BTU)	15.90	64.38	75.61	63.33	38.33
Water (1000 gal)	11.35	38.94	15.17	41.71	39.01
Industrial Solid Waste (cu. ft.)	6.59	38.46	36.13	7.21	108.00
Atmospheric Emissions (lbs)	70.52	261.01	323.02	240.07	145.08
Waterborne Wastes (lbs)	27.43	56.46	69.00	68.79	18.14
Post Consumer Solid Waste (cu. ft.)	7.16	40.97	2.07	27.05	3.49

From: *Association of Vermont Recyclers*

WASTE DISPOSAL

What's Happening To It All?

Grade Level : 8

Subjects:
Science 4.2, 5.
Communication Skills
2.1, 2.2, 2.3, 3.2, 3.3

Time:
three-four class periods
plus some extended
research time

Setting:
classroom, home,
community

Materials:
worksheet

Skills:
interviewing
public speaking
writing

Vocabulary:
incineration
landfill
disposal

Source:
Watauga County
Recycling Curriculum
Committee

Summary: Students will work in small, cooperative groups to collect information and report to the class on the waste management methods being used in our county, state and region. They will also investigate unacceptable methods being used and how widespread these methods are.

Objective: To increase students' knowledge and understanding of the different ways waste can be managed.

Background: The problem of how to manage all the materials we throw away has become one of the most pressing problems of our generation. Investigating the present methods of management and improving on these methods to protect our environment (and ultimately our own survival) should be a priority in our schools and homes.

Leading Question: What is the best way to manage our waste to protect the environment?

Procedure:

1. Divide students into compatible groups of 4-5 students. (You can let students sign up to work on a particular topic based on interest if you wish).
2. Direct groups to appoint the following positions in their groups:

    -Group leader
    This person will keep track of the progress made and help evaluate group members' contributions to the end product.

    -Recorder
    This member will collect the data from the group and with the help of the other group members, put it into written form for class presentation.

    -Timer
    The timer will keep the group aware of deadlines and any other time limits placed on the group for homework or classwork.

    -Oral Presenter
    Responsible for the oral presentation of the group findings.
3. Give each group one of the following assignments to complete:
    -Composting using the Bedminister Method
    -Community Recycling Programs
    -Incineration
    -Landfills
    -Littering
    -Illegal dumping

What's Happening To It All? (continued)

4. Distribute assignment sheets on each of these topics and allow students time to read over these in class and plan a strategy for completing the assignment. Give a deadline for completion of the project.
5. Provide time for each group to share its findings with the class.

What Now?

-Have class write a persuasive letter to the local newspaper convincing readers to use the method of waste management they feel is best. Have students use the guidelines recommended for use on the North Carolina writing test.

-We all produce garbage every day and it must be disposed of in some manner. List all possible methods of disposal and the organization involved in the handling of solid waste. Who pays for disposal of waste?

-Read the National Geographic article "The Fascinating World of Trash" (Vol. 163, No. 4, April 1983).

What's Happening To It All? (continued)

WORKSHEET

Processing Using the Bedminster Method

1. Contact the Bedminster Bioconversion Corporation for information about the process they have developed for converting municipal solid waste into compost.

   Bedminster Bioconversion Corporation
   12 Executive Campus, 535 Route 38, Suite 580
   Cherry Hill, NJ
   (609) 662-2662
   FAX (609) 662-4095

   Contact People:

   Paul T. Hoyle, Vice President Sales and Marketing
   Robert L. Pogyor
   Charles M. Carter

   -When you contact this company, identify yourself and tell them why you are contacting them. Ask for any information they might have about the Bedminster composting process. Ask for any videos, pictures, or other visual information. Be sure to give them your address. If you are writing, submit a copy of the letter to your Recorder to keep in your file.

   -Prepare a written report relating the information you find.

   -Plan an oral presentation for the class. Include any visual information you received (charts, graphs, videos, etc.) or prepare charts and/or graphs yourself.

NOTE: Bedminster composting method is one composting method available. This type of composting takes mixed municipal solid waste and removes inert and foreign particles before producing compost. Compost may also be produced from source separated feedstocks such as yard waste, food waste, cotton waste, paper, tobacco dust, etc. Resulting compost from each process possess differing characteristics.

WORKSHEET

Incineration

In 1995, two communities in North Carolina are incinerating their trash to produce steam heat or to generate electricity. Compare the advantages and disadvantages of these methods to recycling/reuse/ reduction. Contact the Solid Waste Section for a current listing of permitted facilities (919) 733-0692).

ADVANTAGES:

DISADVANTAGES:

-List those materials in solid waste that could be incinerated:

-Contact local private haulers or your local government and find out if any of the solid waste in the local government is disposed of by incineration.

-Complete the activity "Learn to Burn" in the recycling curriculum, page #8.51. (Ask your teacher)

-Use all the data you collected to prepare a class presentation using graphs, charts and any other information and materials you found.

What's Happening To It All? (continued)

WORKSHEET

Landfills

Landfills are still the primary disposal method in North Carolina. Although local governments may no longer operate their own facilities, it may or may not be due to contamination issues. Siting is often difficult due to NIMBY (not in my back yard) syndrome. Local geology may not be well suited and the cost per acre of a new Subtitle D facility may be prohibitive for some local governments depending upon the amount of waste they generate.

List below some of the advantages and disadvantages of this method of disposal:
ADVANTAGES:

____

____

____

____

DISADVANTAGES:

____

____

____

____

-Collect newspaper and magazine articles that deal with landfill issues. Organize these articles into a scrapbook.

-Contact your local newspaper for articles from back issues about local solid waste issues involving disposal.

-Check the school, county, and university libraries for articles from magazines and any other periodicals. You can make copies to include in your scrapbook.

-Clip any pictures you can find which illustrate your topic and arrange them in a collage.

-Prepare a written report and an oral presentation on landfills.

-Contact the North Carolina Solid Waste Section for details on landfills in our state (919) 733-0692.

What's Happening To It All? (continued)

WORKSHEET

Littering

Some people take no responsibility for disposing of their own trash, much less for recycling. These people take the attitude that someone else can do it for them. They do not want to be bothered. Evidence of this mindset is all around us. Your task will be to decide how serious this problem is at school, at home, and in your community.

-Look around every classroom you enter for 2-3 days. Collect all the trash you find on the floor, in shelves, and places other than the waste containers and recycling boxes. Weigh and record this material. Report your findings to your group for the Recorder to keep on a chart.

-Select a section of highway in your community. Use a large garbage bag to collect all the trash you can find that has been thrown out of cars. (Recruit an adult to accompany you) Report back to your group.

-Contact your local solid waste department. Inquire as to whether your local government has a solid waste enforcement officer or other litter enforcement agent. Discuss the problem of littering, the number of citations issued, etc. Ask if your local government requires dump trucks and other open vehicles to be covered to reduce littering along roadsides.

-Total the findings of the group and write a position paper on the problem of littering in our community. Include ways we can solve the problem, what penalties are appropriate for those who are not acting responsibly, and what penalties exist.

WORKSHEET

Illegal Dumping

Because it is difficult to dispose of large household items such as appliances, furniture, and cars, many people choose to dispose of these items by dumping them in remote areas along roadsides. Others make a habit of disposing of all their waste this way.

-Have an adult drive you along rural roadsides. List any items you see that have been dumped along the roadside. Use a county map to pinpoint these locations.

Note: You might make a call to the Department of Transportation or local official to ask for areas that are regularly used for dump sites.

-Find out what penalties are placed on persons caught dumping.

-How are these penalties enforced? (Call your local officials.)

-Write a short, original play depicting a character who dumps his garbage along roadsides. Include in your play the rational for proper waste disposal. Present your play to the class.

WASTE DISPOSAL

Learn To Burn

Grade Level : 8

Subject:
Science 2.1, 2.4, 2.5, 2.7, 2.9, 2.10, 2.12, 2.14, 3.1, 3.2, 3.3, 3.4, 5.1, 6.2

Time:
four - fifty minute class periods

Setting:
classroom (lab if available)

Materials:
one tin can
fireproof pad
one 4-5" square
aluminum soda can
thermometer
matches
scale
trash
air source
glass rod

Skills:
measuring, collecting data

Vocabulary:
incineration
leachate
hazardous waste
turbine generator
composting

Source:
Watauga County
Recycling Curriculum
Committee

Summary: Students will collect trash, weigh it, burn it, and determine the advantages of incineration as a method of solid waste reduction. It is imperative that students make careful measurements and keep accurate records.

Objective: Student will be able to explain that incineration can be used to reduce the volume of waste, produce energy for electricity and is secondary to reuse and recycling.

Background: Any organic waste can be burned and the energy contained in the waste used to produce electricity. While we may prefer to recycle or reuse these materials, they contain usable energy and burning them for that energy may be preferable to their disposal in a landfill.

Leading Question: Does incineration significantly reduce waste and is this method of solid waste management preferable to other methods?

Procedure:

1. Set up the incinerator as illustrated.

2. Explain how the incinerator works.

3. Prepare a sample of each material to be incinerated. (Any foods should be pre-dried by placing in a warm oven for 2-3 hours.) Place these items in the incinerator.

4. Distribute worksheets 1 and 2 and discuss the observations to be made:
    -Weigh the trash in the lower tin can.
    -Add 100 ml water to the soda can.
    -Measure the temperature of the water in the soda can and record.
    -Ignite the trash with a match.
    -DO NOT BREATHE THE FUMES. HAVE WATER AVAILABLE IN CASE OF FIRE.
    -When trash burns completely, measure and record temperature.
    -Weigh the ash in the incinerator. Subtract the number from the first mass to determine the mass and volume loss. THE CHANGE IN MASS IS APPROXIMATELY EQUAL TO THE CHANGE IN VOLUME.
    -Complete worksheet pages 1 and 2 and discuss.

Learn To Burn (continued)

What Now?

1. Calculate the amount of heat generated by the burning trash using the following formula:
    Heat = Mass of Water X Change in Temperature X Sp. Heat
    Mass unit is grams
    Specific heat for water is 1 calorie/gram/degree Celsius

2. Collect, sort, and weigh the family household trash for one week. What percentage of this could be incinerated?

3. Survey household hazardous waste materials that end up in landfills and incinerators.

WORKSHEET

Name ______________________________ Class __________ Date ________________
Instructor ______________________________

Drying Food Mass

Content	Mass before Drying	Mass after Drying

Incineration Data Table

	Trash Content	Mass before burning	Mass after burning	Difference in mass	Water Temperature before burning	Water Temperature after burning
Sample 1						
Sample 2						
Sample 3						

Interpreting Data:

1. What was the change in temperature (Δ) of the water?
2. What was the energy source for the temperature change?
3. Compare the mass of the trash before and after burning.
4. How do you account for the change in mass?
5. What is left after burning the trash?
6. How much did the volume of trash change after burning?
7. What other observations did you make during the burning process?
8. Explain the change in mass during the drying process.
9. What happened to the heat generated from the burning process?

Learn To Burn (continued)

Discussion:

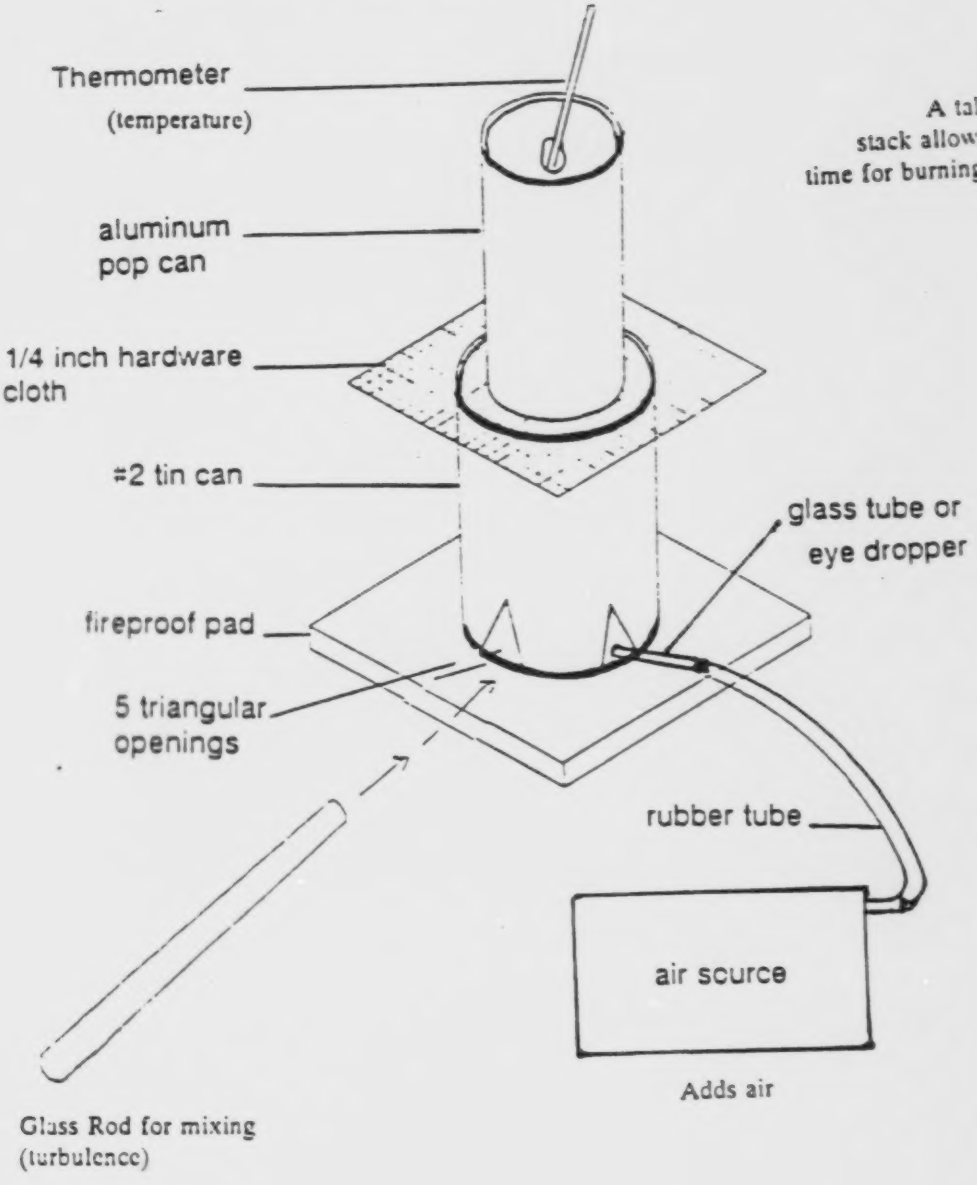
1. What are the advantages of using incineration as a means of solid waste management?

2. What are problems associated with incineration of solid waste?

3. What might some concerns be of people living near a solid waste incineration plant?

4. What can you do to reduce the need for incineration of solid waste?

Incinerator/Calorimeter


Thermometer
(temperature)
aluminum pop can
1/4 inch hardware cloth
≠2 tin can
glass tube or eye dropper
fireproof pad
5 triangular openings
rubber tube
air scurce
Adds air
Glass Rod for mixing
(turbulence)

A tall stack allows time for burning.

Proper incineration requires: time, temperature, turbulence and air.

LOCAL

RESOURCES

Each agency or LEA/school should include those local resources that are specific to their community.

APPENDIX

APPENDIX

Solid Waste Management and Recycling Support Agencies 1

Recycling Periodicals 3

Preferred Packing Practices 4

Innovation Packaging Ideas 5

School Recycling 7

EPA: Characterizing Municipal Solid Waste 17

Smart Program Research:

- *Packaging Waste Results* 19
- *Techniques Used to Measure Packaging Waste* 21

Vermicomposting 23

Seven Ways to Protect Your Family Against Pesticides in Food 33

Recycle Cycle 34

FTC Guidelines on Environmental Marketing 35

Environmental Education Clearing House 41

Bulk Mail Reduction 42

Sources for Funding and Awards Program 43

Curricula and Educational Materials 44

Beyond Recycling: A Waste Reduction Manual for Schools 51

Steel Recycling: Facts and Activities 52

Games and Activities:

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SOLID WASTE MANAGEMENT AND RECYCLING SUPPORT AGENCIES

DIVISION OF POLLUTION PREVENTION AND ENVIRONMENTAL ASSISTANCE
NC Department of Environment, Health, and Natural Resources
PO Box 29569
Raleigh, NC 27626-9569
919-715-6500
800-763-0136
nowaste@owr.ehnr.state.nc.us

DIVISION OF WASTE MANAGEMENT - SOLID WASTE SECTION (SWS)
NC Department of Environment, Health, and Natural Resources
PO Box 27687
Raleigh, NC 27611-7687
919-733-0692
Postmaster@wastenot.ehnr.state.nc.us

OFFICE OF ENVIRONMENTAL EDUCATION (OEE)
NC Department of Environment, Health, and Natural Resources
PO Box 27687
Raleigh, NC 27611-7687
919-733-0711
800-482-8724
ncee@mail.ehnr.state.nc.us

NC COOPERATIVE EXTENSION SERVICE (CES)
Solid Waste Management Extension Specialist
NCSU Box 7625
Raleigh, NC 27695-7625
919-515-6770
sherman@eos.ncsu.edu

ENVIRONMENTAL RESOURCE PROGRAM (ERP)
UNC-CH School of Public Health
CB#8165, Miller Hall
Chapel Hill, NC 27599
919-966-7754

SOLID WASTE MANAGEMENT AND RECYCLING SUPPORT AGENCIES - (continued)

ENVIRONMENTAL EDUCATORS OF NORTH CAROLINA (EENC)
PO Box 4901
Chapel Hill, NC 27515

NORTH CAROLINA RECYCLING ASSOCIATION (NCRA)
7330 Chapel Hill Rd., Ste. 207
Raleigh, NC 27607
919-851-8444
ncrecycles@aol.com

NATIONAL RECYCLING COALITION (NRC)
1727 King St., Ste. 105
Alexandria, VA 22314
703-683-9025

RECYCLING PERIODICALS

BIOCYCLE
(monthly)
Journal of Waste Recycling
Box 351
Emmaus, PA 18049
215-967-4135

RECYCLING COORDINATOR
76 North Maple Avenue
Suite 152
Ridgewood, NJ 07450

RESOURCE RECYCLING
(7 times per year)
PO 10540
Portland, OR 97210
503-227-1319

WASTE AGE
(bi-weekly)
Recycling Times
The Newspaper of Recycling Markets
5615 W. Cermak Road
Cicero, IL 60650
202-861-0708

WASTE AGE
(monthly)
1730 Rhode Island Avenue NW
Suite 1000
Washington, D.C. 20036
202-861-0708

PREFERRED PACKAGING PRACTICES

The Coalition of Northeastern Governor's (CONEG) Source Reduction Task Force has published a hierarchy for preferred packaging practices as follows:

1. **No Packaging**
   The need for any packaging should be evaluated in the research and development stages and prior to introduction on the market.

2. **Minimal Packaging**
   Alternative methods of product and packaging design should be pursued to minimize the packaging material required.

3. **Consumable Packaging**
   Manufacturers should consider consumable packaging that is eliminated in the process of using the product.

4. **Returnable Packaging**
   Manufacturers should consider packaging that is returned to a business or industry for reuse and redistribution.

5. **Refillable / Reusable Packaging**
   Manufacturers should consider refillable / reusable packaging that can be refilled by a customer or consumer from bulk or larger size containers. For example, consumers could refill the small liquid soap dispensers in restrooms with a bulk container.

6. **Recyclable Packaging / Recycled Material in Packaging**
   A package is considered recyclable if there is an economically viable and widely available collection, processing, and marketing system for the material. Recyclability of a package is maximized when it is made of a homogeneous material or of materials that do not need to be separated prior to recycling. Labels, closures, and seals should be made of material similar to the primary package.

   Recycled content should be the greatest amount of post-consumer material possible. The use of in-plant or mill scrap alone is not sufficient to be considered recycled-content packaging.

INNOVATIVE PACKAGING IDEAS

Many companies have successfully implemented source reduction programs for packaging. These programs have not only reduced the waste stream but, in many cases, have yielded a profit and increased productivity, as in the following examples:

1. **Packaging Elimination / Size Reduction**

   - By combining a desktop workstation, monitor, system unit, keyboard, mouse, and software in a single set of polystyrene cushions, IBM eliminated over 8 million square feet of corrugated cardboard and saved $736,000.

   - Proctor & Gamble reduced 3.4 million lbs./year of paperboard by removing the carton from *Secret* and *Sure* deodorants.

   - Proctor & Gamble reduced its *Crisco* cooking bottle by 30% by switching to a new, ultra lightweight square-shaped bottle. The square shape improves gripability, reduces storage space thereby reducing shipping and warehouse costs. The change saves 2.5 million pounds of plastic and 1.3 million pounds of corrugated shipping material each year.

   - By eliminating the plastic covering for Craftsman screwdrivers and pliers, Sears reduced 78 tons of plastic a year.

   - By reducing the thickness of the plastic bag in its cereal boxes by 12 percent, General Mills saved 500,000 lbs./year of plastic.

2. **Material Substitution**

   - By switching its packaging materials from corrugated cases to reusable polyurethane cushions, Steelecase, a leading maker of office furniture, was able to eliminate 2.4 million lbs./year of solid waste. The unpackaged chairs increase truck space by 58 percent and material cost savings are estimated at about 20 percent. In addition, 5,000 square feet of warehouse space has been cleared.

   - Efco Products, Inc., responded to a request from Dunkin' Donuts to replace the 40- to 45-pound plastic pails used to ship creme, jellies, and fruit fillings with plastic pouches that use 90 percent less plastic.

   - Several caulk and sealant makers have reduced packaging by 86 percent by designing refillable caulking guns that replace cardboard cartridges with chub packages like those in which sausages are packaged. Guns for use with chubs are sold by Albian Engineering Company in Philadelphia. Contact Paul Bueter, (215) 535-3476.

   - Ben & Jerry's is now packaging its *Peace Pops* ice cream bars in flexible bags rather than individual boxes. The change saves 8 to 11 million boxes, and up to 165 tons from disposal each year.

3. Packaging Structure Redesign

- IBM modified four corrugated packaging designs by replacing the former top-load carton with a new end-load design: the modification eliminated over 2000 square feet of cardboard and saved $121,000.

- By redesigning its folded carton, the Oak Tree Packaging Corporation reduced paperboard usage by 40 percent. Oak Tree customers can achieve approximately a 15-percent reduction in carton expenditures.

4. Developing Reuse Opportunities

- Resource America has introduced a system to provide customers of electronic companies with "return kits" for leftover packages. The kits include a prepaid mailing label and easy-to-understand instructions for returning the packaging material to an authorized collection point.

5. Selected Packaging Contacts

May of the organizations listed below provide newsletters and up-to-date information on waste reduction in the packaging industry.

Institute of Packaging Professionals
481 Carlisle Drive
Herndon, VA 22070
(703) 318-8970

Council on Packaging in the Environment (COPE)
1255 23rd Street, N.W., Ste. 850
Washington, D.C. 20037
(202) 331-0099

Flexible Packaging Association
Glenn Braswell, President
1090 Vermont Avenue, N.W., Ste. 500
Washington, D.C. 20005
(202) 842-3880

Appendix
School Recycling

I. Identify markets

A. First, discuss school recycling with County or Municipal Solid Waste Management, or the Public Works Director. See *Recycling Contacts* in the Guidelines for the Collection of Recyclable Materials. They might supply much of the information needed below, or assume some part of work for school recycling.

1. **Identify Potential Recyclables Markets** Find Recyclables Markets for your area using the information provided by the *Guidelines* , by County/Municipality Waste Management, or your Public Works Director.

Paper market name:____________ Rndtrip distance:______ Ph #______
Categories/quality criteria:________________________
______________________ Price/100 lbs:______

Paper market name:____________ Rndtrip distance:______ Ph #______
Categories/quality criteria:________________________
______________________ Price/100 lbs:______

Paper market name:____________ Rndtrip distance:______ Ph #______
Categories/quality criteria:________________________
______________________ Price/100 lbs:______

Cardboard Mkt:__________ Roundtrip distance:___ Ph #______ Price/100 lbs___

Aluminum Mkt:__________ Roundtrip distance:___ Ph #______ Price/100 lbs___

Polystyrene Mkt:________________ Roundtrip distance:___ Ph #___
______________________ Cost:__ _____

Other (food waste, glass, cans)________________________
______________ Roundtrip distance:___ Ph #_____ Price/100lbs.___

2. **Identify Potential Waste Haulers.** Prepare to give potential haulers an estimate of weekly route mileage, pick up time, distance to market, and # of trips/month.

Number of schools in system (# of pickup stops):_____ Total route mileage:_____
Person-hours needed to drive:_______. Person-hours needed to pick up:_______
(pickup = 15 min. per stop w/out sorting, and 45 min.- 1 hour per stop w/sorting)

Rndtrip dist. paper market: ________# trips/month:_____ Miles/mo.:_______
Rndtrip dist. paper market: ________# trips/month:_____ Miles/mo.:_______
Rndtrip dist. paper market: ________# trips/month:_____ Miles/mo.:_______
Rndtrip dist. cardbd. mkt.: ________# trips/month:_____ Miles/mo.:_______
Rndtrip dist. polystryrene mkt.: _____# trips/month:_____ Miles/mo.:_______

Hauler contact person

__________ Ph#_______ Fee/rate_______ recyclable:______
__________ Ph#_______ Fee/rate_______ recyclable:______
__________ Ph#_______ Fee/rate_______ recyclable:______
__________ Ph#_______ Fee/rate_______ recyclable:______

SOURCE: Chatham County School Recycling Program.

School System Recycling Implementation Worksheet

II. Set Priorities and Responsibilities

A. Setting Priorities

1. **Assemble potentially involved people** — Name & Ph. #
   - Superintendent of Schools
   - Local Govt. (Waste Mgr., Recyc. Coord., Pub. Wks.)
   - Child Nutrition Specialist (head)
   - Director of Maintenance
   - Principals
   - Teachers from each school concerned with recycling

2. **Discuss possible/desired participation.**

   a. **Be prepared to present this group (or subgroups) with:**
      - **the excerpt from S.B. 111 included in this packet**
      - **an overall feasibility estimate (information gathered in Step I. above)**
      - **the fact that estimated school recyclables output is 3 recycling bins (96 gal.) paper & cardboard, and 3-4 bins styrofoam (if disposables used in cafeteria) per 500 students/week (1st year avg.).**

   b. **Resolve the following questions with representatives of each school:**
      i. **Have students, parents, or staff expressed desire to recycle school paper?**
      ii. **Given regular pickup and systemwide coordination, is school paper recycling feasible in every school? Consider:**
         - **central storage for weekly pickup (Where? If in halls, fire law requires clear passageways)**
         - **are classrooms too crowded for boxes on the floor or under a table?**
         - **can students handle sorting and getting the paper to the central bins?**
         - **school paper recycling requires almost no time and little trouble, but it requires a change in attitude. Will *enough* staff be able to change?**

   c. **Which schools will commit to recycle paper? Can you list schools that will recycle paper, school representatives, start dates, and # of centralized bins needed to accommodate a weekly pickup schedule:**

School and Name of School Recycling Representative		**Start Date**	**# of bins Needed**
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		
School:	Rep.:		

School System Recycling Implementation Worksheet

d. Is it desirable or feasible to recycle from the cafeterias? Discuss:

- cardboard to be recycled must be stored for a few days after unpacking boxes
- food waste might or might be recyclable
- polystyrene trays, cups, and utensils cost money to recycle. Students must be able to carefully stack trays.
- styrofoam trays must be stored in covered containers to await pickup
- cafeteria sorting might require extra garbage cans for sorting.
- large cafeterias pose special sorting problems because of the extra time required for students to separate at the disposal barrels
- cafeteria sorting requires student and staff understanding and cooperation

e. Which schools might commit to cafeteria recycling? At preliminary meetings simply indicate which school cafeterias might recycle. The table is to help discuss the matter. Later, the coordinator needs to know which cafeterias will recycle, whether kitchen only, cafeteria only, or both, and what materials they will recycle. A cafeteria recycling planning worksheet is included in this packet to help gather this and other information.

Cafeteria Recycling

School	Start Date	Materials to Be Recycled
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:
School: Cafeteria manager: Cafeteria Ph. #		Materials from Kitchen: Materials from Cafeteria:

School System Recycling Implementation Worksheet

f. Discuss education of students/staff. (For later stage, not preliminary meetings In both classroom and cafeteria, staff and students must know the sorting categories and be willing to sort. Education precedes cafeteria and classroom recycling and follows development of:
  i. standardized labelling for containers
  ii. standardized education and terminology on paper sorting
  iii. ~~large~~ signs above cafeteria recycling barrels (made by art classes in school)

School	Recycling Educator	Education Completion Date

B. **Financial and Other Support from the Community** School personnel might know of community help from PTA's, school foundations, private foundations, local government, or local industry. Potential Contributors: ____________________

____

____

People responsible for securing commitments: ____________________

____

C. **Setting Responsibilities** The School System Recycling Coordinator should begin the 1st 2-3 mohths as a HALF-TIME POSITION to accomplish the 1st 3 items below. Maintaining the project (remaining 8 items) require about 5 hours/week.

- Establish markets and recyclables transport system and schedule (or work with County Solid Waste Management to do so)
- Organize school staff and administration involved in recycling to establish degree of participation, sorting categories, and pickup schedule
- Purchase recycling equipment and provide standardized container labels
- Maintain recyclables pickup schedules
- Monitor school recycling sites and equipment
- Answer emergency calls
- Help teachers and student groups develop recycling activities
- Update sorting procedures as markets shift
- Provide schools with training or updates as needed
- Establish a "recycling corner" in the system newsletter and report to newspaper

School System Recycling Implementation Worksheet

- Provide feedback on waste reduction, sorting quality, and level of participation

Sample Principal Responsibilities School administrators often set the tone and coordinate education of staff and students regarding recycling.

- Plan and discuss the school's program with teachers/staff
- Identify a teacher to be responsible for recycling and communications with School System Recycling Coordinator
- Set recycling procedures and standards with cafeteria manager
- Oversee purchase of recycled paper products

Sample Teacher Responsibilities Teachers often make sure that paper gets sorted in the classroom and set the tone for students. They typically take several roles:

- Coordinate recycling in the classroom
- Serve as liaison/planner with school administration and school contact person for System Coordinator. This is a key position.
- Be PTA or Student Council liaison; identify parent volunteers
- Designate students to report on recycling to school paper, system newsletter, and local newspaper
- Oversee schoolwide recycling activities
- Contact speakers for class or school presentations

Sample Student Responsibilities After school begins, the School System Recycling Coordinator might keep a file on each school. Part of the file lists students who report to newspapers or work with student government or clubs involved with recycling. Student responsibilities often include:

- Check classroom paper sorting containers for contaminates and re-sort
- Take classroom paper to central pick up sites
- Create signs to identify sorting categories
- Serve as student council recycling liaison
- Crush cardboard and cans
- Report on schoolwide recycling to the school paper

III. Purchase Equipment, Plan Logistics

A. A rough estimate of the quantities per school helps schedule routes. Roughly:

- each 500 students produce about 3 bins (96 gallons) paper and cardboard/wk.
- cafeterias serving 500 on disposables produce about 15-20 bags polystyrene/wk., and a stack of cardboard 3 ft. high (requiring at least 1 pickup per week).

If capacity of available vehicles is low (ie. vans), routes need be scheduled so as not to overfill vehicles. ,

1. **Pickup Schedule** After discussing recycling with schools, estimate recyclables volume they will generate to set a regular pick up schedule. When purchasing equipment (#2 below), establish sufficient on-site storage space for at least 1-week. Finalize agreements with hauler(s) so that agreements include a pickup schedule for each school, scheduled trips to market, and cost. It is vital that paper and cafeteria pickups not be missed. If pickups could potentially be missed, establish backups. Everyone involved with the program should have the school system recycling coordinator's phone #, the one number to call if anything goes wrong with recycling, especially if a pickup is missed.

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School System Recycling Implementation Worksheet

Paper Hauler:________________________________ Ph#__________
Pickup days:________________ Trip to market days:________________

Polystyrene Hauler:________________________________ Ph#__________
Pickup days:________________ Trip to market days:________________

Cardboard Hauler:________________________________ Ph#__________
Pickup days:________________ Trip to market days:________________

Aluminum Hauler:________________________________ Ph#__________
Pickup days:________________ Trip to market days:________________

School	Estimated Volume/Schedule			
	Paper	Polystyrene	Cardboard	Aluminum
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:
	# bins: pickup days:	# bags: pickup days:	pickup days:	# bins: p/u day/wk:

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School System Recycling Implementation Worksheet

3. **Equipment** School systems' equipment needs depend on what government and commercial haulers provide. Below is a "worst-case" list of equipment needed where virtually no recycling equipment was available.

Item	Vendor	#Needed	Estimated Cost	Actual Cost	Total
Weatherproof Enclosure	School shop		$92.75		
18-Bushel Postal Hampers for handling and sorting paper	C. R. Daniels		$203.85		
96-Gallon Covered Polyethylene Rollout Recycling Bins	Toter, Inc.		$63.24		
16' Trailer and Hitch	S. Alamance Trailers		$4,635		
Styrofoam Tray stackers	Amoco		$0		

See the "Equipment Guide" included with this packet to identify and price equipment you think you might need.

School System Recycling Implementation Worksheet

Cafeteria Recycling Information Sheet

For use by the school system recycling coordinator to gather information at each school cafeteria during a 20-minute after-school meeting with the cafeteria manager, principal, custodian, and a teacher.

General

school__________ cafeteria mgr.__________
custodian working in cafeteria__________ teachers__________
avg. # served daily______ time lunch begins______ time lunch ends______
# of shifts__________ snack?__________
recycling in kitchen only?______ cafeteria only?______ kitchen & cafeteria?______
planned location of recycling area in cafeteria__________
Need a recyclables enclosure? ______ Where? __________ Size:______
Pickup location__________ Pickup schedule__________

Polystyrene Recycling

Disposables? ______ if yes, polystyrene stackers needed?__________
Does cafeteria have clear plastic bags for styrofoam and plastic?__________

Cardboard, Aluminum (non bev. can), Glass, and Plastic

Cardboard volume______ Aluminum volume ______ Glass volume ______
HDPE volume______ PETE volume______

Food Scraps

Bags/day______ from cafeteria ______ from kitchen = total______
Need to contact Mr. Reaves (542-3487 after 8:30 pm)?______ Enough trash cans?______

Logistics and Responsibilities

Who could make recyclables enclosure? (Shop tchr?):__________
Who will be responsible Aluminum Beverage can Recycling?__________
Who will teach staff/students about cafeteria sorting procedures?__________
What student groups will work to inform students?__________
Student representative__________
Faculty representative__________
Who will make signs to indicate what goes in containers (preferably laminated with space to attach examples)__________
Who monitors cafeteria recycling areas?__________
Special problems?__________
Starting Date__________

School Recycling Cost/Benefit

STARTUP COSTS

Materials cost weatherproof enclosures @:	$92.75	
Total for 6 enclosures:		$556.50
Cost 18-bushel postal hampers for paper sort	$203.85	
Cost 4 sorting hampers:		$815.40
Cost 96-gallon rollout bins (Toter) @:	$63.24	
Cost 64 units		$4,047.55
One 8' x 6' x 16' trailer and hitch		$4,635.00
Total startup materials cost		**$10,054.45**
Yearly cost (over an estimated lifetime of 10 years):		**$1,005.45**
Yearly cost per school:		**$77.34**
Weekly startup cost per school (38 weeks):		**$2.04**
Weekly startup cost whole system (38 weeks):		**$26.46**

PROGRAM MAINTENANCE COST

Gas/Mileage for pickup for the academic year (38 weeks):	$1,567.00	
Coordinator's time (5 hrs/week x 38 weeks) $10/hr	$1,900.00	
Labor ($7/hr) for 38 weeks' pickup/delivery (25 hrs/wk)	$6,650.00	
Labor ($7/hr) for 38 weeks' paper sorting (10 hrs/wk)	$2,660.00	
Yearly total labor cost each school (38 weeks):	$862.31	
Weekly labor cost each school (38 weeks):	$22.69	
Total labor cost for whole school system for the year:	$11,210.00	
Styrofoam Recycling cost (38 weeks):	$328.00	
Yearly Maintenance Cost (whole school system):	**$13,105.00**	
Yearly maintenance cost per school:	**$1,008.08**	
Weekly maintenance cost per school:	**$26.53**	
Weekly maintenance Cost (whole school system)	**$344.87**	
Combined startup + maintenance: weekly cost per school	**$28.56**	
Combined startup + maintenance: weekly cost (whole system):		$371.33

FINANCIAL GAINS FROM RECYCLING

On average, schools recycled roughly 1,000 lbs. daily.
The upcoming construction of a new landfill will more than double the county's current $55.00/ton landfilling cost .
The county solid waste manager estimates that each 1,000 lbs diverted from landfilling saves the county $68. Therefore, each week, school recycling:~

saved Chatham Co.:	$340.00	
Weekly salvage avg. $35-$50. Total weekly savings + earnings =		$382.50
On average, each week, the County gained:		$11.17

Possible Funding Opportunities

School Level

1. Your local PTA

   Proposals for funding are accepted in spring for fall allocations.

2. Your school system's development office

3. The public education fund or foundation established to support your school system

   There are an estimated 60-70 such organizations currently operating in N.C. An example of this type of organization is the Wake County Education Foundation at 2302 Noble Road, Raleigh, N.C. 27608, tel. (919) 821-7609.

   The Wake County Education Foundation is planning to adopt a United Way format and expand its funding to include diverse educational projects within the Wake County Schools. The Foundation will be prepared to accept proposals beginning in 1992.

   Educational funds and foundations provide a unique opportunity for school systems to acquire local corporate financial support.

Local Level

1. Municipal/County Budget Appropriations

2. Your local 4-H club

   4-H is a division of Cooperative Extension Services, once known as the Agricultural Extension. Recently, county offices of Cooperative Extension Services have initiated recycling projects and composting education efforts in communities across the state.

State Level

1. N.C. State Solid Waste Trust Fund

   Contact: Office of Waste Reduction
   N.C. Department of Environment, Health, and Natural Resources
   P.O. Box 27687
   Raleigh, NC 27611-7687
   (919) 571-4100

   The Office of Waste Reduction accepts proposals for funding in an annual competition. Proposals for 1991 were accepted through June. The awards will be announced in late August. Information on next year's competition can be obtained from the Office of Waste Reduction.

United States
Environmental Protection
Agency

Solid Waste and
Emergency Response
(OS-305)

EPA/530-F-92-019
June 1992

Office of Solid Waste

EPA

Environmental Fact Sheet

Characterizing Municipal Solid Waste: Facts and Figures

EPA recently released the 1992 Update to its report "Characterization of Municipal Solid Waste in the United States." MSW refers to waste generated by commercial and household sources that is typically collected and disposed in municipal solid waste facilities. The report presents information from 1960 to 1990 on waste generation, disposal, combustion, and recovery through composting and recycling. This fact sheet highlights some of the report's key findings reflecting national approximations and projections.

The Current Picture

Recycling Makes Large Gains

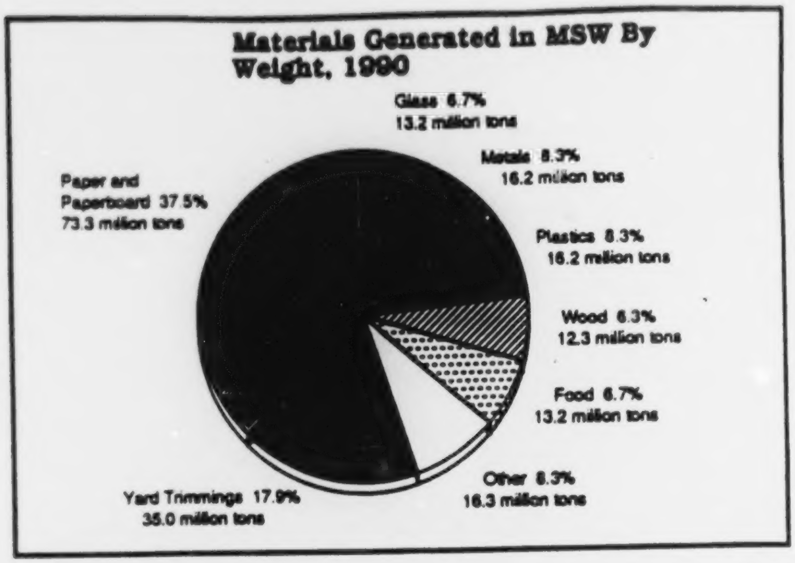
In 1990, Americans generated 195 million tons of municipal solid waste, an eight percent increase over 1988. Of this total, 33 million tons were recovered for recycling or composting, representing a 17 percent recycling rate in 1990. This compares to a 13 percent rate in 1988. The amount of yard debris that was collected for composting increased dramatically, from 2 percent of yard debris in 1988 to 12 percent in 1990. The net result is that between 1985 and 1990, the amount of material recovered annually from MSW more than doubled, from 16.4 to 33.4 million tons. Two important factors in these improvements are the efforts of communities to compost yard trimmings and to set up recycling programs, and the efforts of manufacturers to use more recycled materials recovered from MSW.

Waste Generation Rates Also Rising

Despite this good news, Americans [illegible] still producing more garbage today than ever before. In 1988, U.S. households, commercial establishments, and institutions generated 180 million tons of MSW, or 4 pounds per person per day (ppd). In 1990, the per capita waste generation rate jumped to 4.3 ppd. So, although Americans recycled more, they also generated and threw away more: evidence that many opportunities for recycling and source reduction still exist. (Simply put, source reduction is waste prevention. It includes many actions that reduce the overall amount or toxicity of waste created.)

MSW Management After Recycling and Composting

In 1990, 16 percent of all MSW was managed by combustion, up from 14 percent in 1988. The amount of MSW landfilled is on the decline, from 73 percent in 1988 to 67 percent in 1990. The study projects an increase in combustion with energy recovery and a continued decrease in landfilling through the 1990s.


Materials Generated in MSW By Weight, 1990

This pie chart illustrates the composition of the nation's 1990 waste stream by material type. Composition will likely vary based on local conditions. Figures are based on data from the EPA Report: "Characterization of Municipal Solid Waste in the United States: 1992 Update."

Future Trends

Waste Generation

EPA projects that while the amount of waste generated in the U.S. will continue to increase during the 90's, it will do so at a much slower rate. Per capita waste generation is not expected to reach 4.5 ppd until 2000, in part due to source reduction efforts. As additional source reduction initiatives build on progress through activities like backyard composting, reduction of packaging materials, and production of more durable products, we may be able to actually reduce the per capita rate. However, a wide range of variables affect waste generation rates, including cultural and demographic changes, shifts in work patterns, the economy, technical innovations and efforts in source reduction. The number of variables make overall waste generation patterns difficult to predict.

Recycling

EPA's MSW report also develops several possible recycling scenarios for the years 1995 and 2000. These scenarios project recycling rates of 20 - 30 percent in 1995 and 25 - 35 percent in 2000. To achieve the highest projected rates, affected industries would need to continue to invest in plants and equipment to utilize recovered materials; the growth in yard debris composting would also need to continue; most citizens would need access to recycling programs; and secondary materials markets would have to continue to grow.

For More Information

The information in this Fact Sheet is based on the EPA report *Characterization of Municipal Solid Waste in the United States: 1992 Update*. For a free copy of this report's executive summary, call the RCRA Hotline, toll free, at (800) 424-9346, or TDD (800) 553-7672, for the hearing impaired. In the Washington, D.C. area, the number is (703) 920-9810 or TDD (703) 486-3323. Copies of the entire report are available for a charge through the National Technical Information Service by calling (703) 486-3323.

FACT SHEET

SMART program research: Packaging waste results

Each of us produces an average of four pounds of garbage every day. Some is being recycled. But the rest must be managed: either by burying it in a landfill, burning it in a waste-to-energy plant or composting it.

About two-thirds of household garbage is packaging from food, cosmetics, toys and other items we buy. One way to reduce trash is to shop with packaging in mind and look for "least-waste" alternatives.

But what are the alternatives? Which ones generate the least waste?

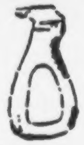
The Minnesota Office of Waste Management (OWM) studied consumer product packaging. The results show that packaging choices do matter, in terms of both cost and waste.

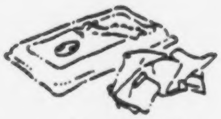
Research results

Waste

less — more

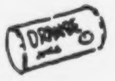
Glass Cleaner

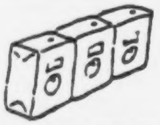

Liquid pump bottle


Pre-moistened wipes

Less waste, volume: 1239 ml, 61%
Less waste, weight: 172 g, 71%
Less expensive: $0.70, 26%

Orange juice


12-oz. can frozen concentrate

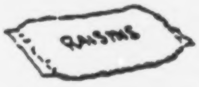

3-pack ready-to-drink boxes

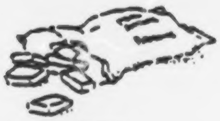
Less waste, volume: 745 ml, 83%
Less waste, weight: 86 g, 74%
Less expensive: $1.33, 55%

Waste

less — more

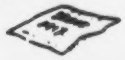
Raisins

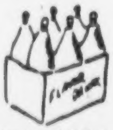

1.5-lb plastic bag


14 mini-snack boxes in bag

Less waste, volume: 1108 ml, 97%
Less waste, weight: 112 g, 93%
Less expensive: $1.74, 47%

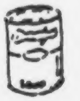
Non-carbonated soft drink

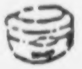

6.13-oz powder packet *


6-pack plastic bottles

Less waste, volume: 2693 ml, 99%
Less waste, weight: 218 g, 99%
Less expensive: $2.64, 93%

Chicken Noodle Soup (II)


Condensed can


Microwave single

Less waste, volume: 296 ml, 46%
Less waste, weight: 42 g, 46%
Less expensive: $2.30, 82%

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continued on other side

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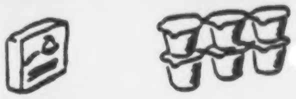
Recycled Paper

Waste

less | more

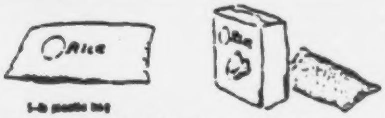
Pudding



3.5-oz. instant box * | Snack 6-pack

Less waste, volume: 822 ml, 89%
Less waste, weight: 47 g, 73%
Less expensive: $1.60, 64%

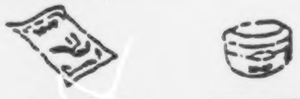
Rice



5-lb plastic bag | Boil-in-bag box

Less waste, volume: 2726 ml, 98%
Less waste, weight: 314 g, 96%
Less expensive: $3.75, 47%

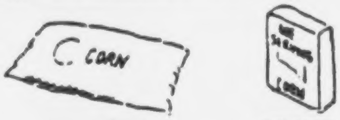
Chicken Noodle Soup



Instant single | Micro wave single

Less waste, volume: 211 ml, 98%
Less waste, weight: 28 g, 91%
Less expensive: $0.60, 65%

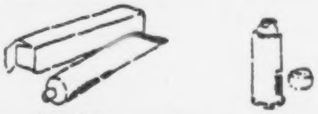
Frozen Corn



20-oz. plastic bag | Single serving 4.5-oz. box

Less waste, volume: 1006 ml, 98%
Less waste, weight: 115 g, 94%
Less expensive: $2.45, 59%

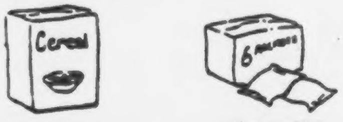
Toothpaste



6.4-oz. tube | 4.5-oz. pump

Less waste, volume: 229 ml, 69%
Less waste, weight: 55 g, 58%
Less expensive: $1.00, 36%

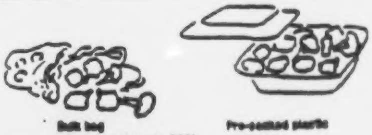
Cereal



20-oz. box | 3.27-oz. snack box

Less waste, volume: 1489 ml, 50%
Less waste, weight: 174 g, 55%
Less expensive: $2.74, 45%

Pre-cut Broccoli



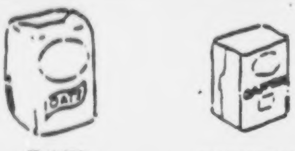
Bulk bag | Pre-packed plastic container

Less waste, volume: 194 ml, 89%
Less waste, weight: 23 g, 87%
Less expensive: $0.70, 31%

Waste

less | more

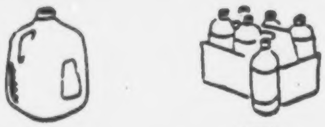
Oats



72-oz. bag | 12-pack instant box

Less waste, volume: 1719 ml, 84%
Less waste, weight: 303 g, 88%
Less expensive: $10.75, 72%

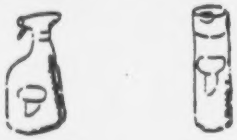
Spring Water



1-gallon jug | 6-pack 12-oz plastic bottles

Less waste, volume: 4223 ml, 83%
Less waste, weight: 310 g, 80%
Less expensive: $4.38, 87%

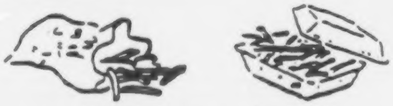
Furniture Polish



Pump spray bottle | Aerosol can

Less waste, volume: 176 ml, 29%
Less waste, weight: 33 g, 29%
Less expensive: $0.57, 20%

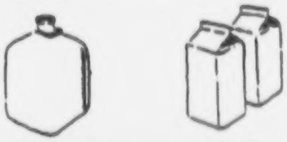
Pre-cut Carrots



Bulk bag | Pre-packed plastic container

Less waste, volume: 194 ml, 89%
Less waste, weight: 23 g, 87%
Less expensive: $2.00, 56%

Milk



1-gallon returnable | half gallon cardboard carton

Less waste, volume: 771 ml, 99%
Less waste, weight: 113 g, 98%
Less expensive: $0.11, 4%

*Figures do not include cost of additional ingredients added by consumer. All figures are based on an equivalent amount of product. Prices were determined from shelf labels in fall 1991 and will vary slightly according to location and brand. Volume was uniformly compacted and is a conservative estimate of household waste.

Additional information is available from the OWM, 612-649-5750 or 800-652-9747 toll-free in Minnesota. For educational materials, ask for the Waste Education Clearinghouse. For information on OWM's waste education program, ask for David Wirwahn. For technical information on measurement design, ask for Ken Brown.

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FACT SHEET

SMART Shopping:
Techniques used to measure packaging waste

The Minnesota Office of Waste Management (OWM) initiated a project to measure consumer product packaging waste and make consumers aware of the results through a promotional campaign in grocery stores. The promotional campaign is called SMART Shopping: Saving Money and Reducing Trash.

The OWM measured waste and cost differences when the same consumer product is marketed in different packaging. The following questions and answers summarize the OWM's design for measuring the volume, weight and cost of various grocery products.

• • •

What types of products were measured?
Phone logs showed that most packaging questions from the public concerned grocery products. In addition, virtually everyone uses grocery stores and is familiar with their products. Although hardware stores, for example, also have an array of products in packaging, grocery products were selected for this project because they affect more people's lives more frequently.

What types of waste were measured?
A decision was made to measure the solid waste that consumers must handle after they empty the package of its contents. This data is obtainable because solid waste has a definite volume and weight. Data concerning waste that occurs during manufacturing is not readily available, if at all. No attempt was made to include it in the packaging waste evaluation. For the same reason, the relative toxicity of different packaging waste was not taken into account. Solid waste that must be managed by the consumer was the only waste considered in this assessment.

Which grocery products were selected for measurement?
To make the study as broad as possible, different supermarket departments were analyzed. As many different packaging types as possible were studied. Within this framework, different packaging of the same product needed to be of the same name brand whenever possible. This assured that the analysis would measure costs associated with packaging rather than costs associated with different product manufacturers.

What about recyclability or recycled content of packaging?
Materials collected for recycling vary from community to community. Because of this, the study measured amounts of packaging waste only, and not the recyclability of that waste. Types of packaging with recycled content are also changing, so the scope of the study did not include whether the waste was made of recycled content.

What about factoring in packaging convenience as a part of the evaluation?
The rapid increase in convenience packaging demonstrates that consumers want convenience. However, "convenience" is too subjective for consistent measurement, and the study did not factor it into evaluation of packaging.

What types of grocery stores were chosen?
To answer this question, different types of supermarkets, from upscale food stores to food co-ops to warehouse-type grocery stores, were visited. Mainstream supermarkets were chosen because most people are familiar with these stores and their products.

How were products chosen for measurement?
Researchers surveyed several departments, such as produce, dairy, hygiene, and paper goods. They looked for different packaging of the same product of the same name brand. Cost and description of the product and its packaging were noted. This information was analyzed, and 17 diverse products with contrasting packaging were chosen for measurement.

How were costs for an equivalent amount of product measured?
Since costs were known from purchases and the amount of ounces of product were listed on the package, the cost of each ounce of product was readily available.

How was weight of packaging waste determined?
Two electronic scales, like those found in a

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Recycled Paper

chemist's laboratory, were used. One scale was for large packages, the other for small packages. Measurements were rounded to the nearest .1 gram. Packages were weighed full, then emptied as a consumer would empty them and the packaging weighed alone. Containers were not washed before weighing because consumers do not wash packaging before throwing it out. Waste was weighed in the form it would be handled by the consumer.

How was the volume of waste measured?
For containers with square corners, volume was determined using a ruler. For more complex shapes, water displacement was used. Small packaging was submerged in water in a 100-ml graduated cylinder. The change in water level was noted. Large packaging was submerged in a five-gallon cylinder.

Design of the five-gallon cylinder
A one-inch hole was drilled near the top of a five-gallon cylindrical container, and a 1-1/2-inch-long tube was inserted. The container was filled with water until it overflowed from the tube into a sink.

Packaging was submerged in the water. As the packaging displaced water, the water flowing out of the tube was collected in a graduated cylinder for measurement. *Note: Volume can also be obtained by weighing the amount of water displaced. One gram = .061 cubic inch.*

Was the empty packaging waste compacted?
Although many consumers simply drop packaging waste into a trash can, some use trash compactors. Others pack waste down into their trash cans. For consistency, the OWM compressed packaging waste in a residential KitchenAid trash compactor. This gave a relatively conservative estimate of packaging waste volume. Structurally strong containers, such as aerosol cans, were not crushed in the compactor because most consumers do not have compactors, and they must deal with such rigid containers as uncompacted waste.

Is the volume of packaging waste in a trash can the same as the volume shown by water displacement?
Every empty space in a discarded package is not filled with trash when it is put in a trash can. But all the spaces are taken up with water when the package is submerged. This difference will result in severe underestimation of the amount of space packaging waste can take up in a trash can. To rectify this problem, packages were placed in a thin plastic bag so that air could escape from the bag as it was submerged. This resulted in a measurement more representative of a consumer's packaging waste.

How were the calculations made?
Cost: Because the cost and amount of product in each package is known, the cost for an equivalent amount of product for each is easily calculated. *Cost divided by number of ounces of product = Cost per ounce of product.*

Volume: It was important that equivalent amounts of product be compared, whether in ounces or through use. Each package had a measurable number of ounces of product. For window wipes it was the number of square feet the packaged product could clean. *Compacted volume of empty package divided by ounces of product in package = Waste volume of package per ounce of product.*

Weight: The same procedure was used to assess weight for an equivalent amount of product. *Weight of empty package divided by ounces of product in the package = Weight of package per ounce of product.*

Waste volume and weight of different packaging were then compared.

How were concentrates versus ready-to-use products evaluated?
Concentrates were mixed with water in reusable containers. The waste that occurs when the consumer eventually discards the reusable container was not part of this study.

Ingredients such as sugar must sometimes be added to concentrates. Different consumers use different amounts. The waste generated by the sugar bag could be calculated to give "waste per cup of sugar." This waste was estimated to be relatively insignificant when compared to packaging waste from the concentrate. For these reasons, extra ingredients were not part of waste calculations.

How was waste from returnable containers dealt with?
With reusable packaging, such as returnable milk jugs, only a thin label and a cap are discarded. The container is reused; only the label and cap were measured as waste.

Conclusion

Research shows that additional layers of packaging, ready-to-use dilutes and single-serving packaging not only increase waste, but also increase cost. Though packaging is needed for protection of many products, it can be overused. Packaging has an environmental and economic price, and the price is significant.

Additional information is available from the OWM, 612-649-5750 or 800-652-9747 toll-free in Minnesota. For educational materials, ask for the Waste Education Clearinghouse. For information on OWM's waste education program, ask for David Wirwahn. For technical information on measurement design, ask for Ken Brown.

VERMICOMPOSTING

What is vermicomposting?

Vermicomposting is the process of letting red worms turn your kitchen food scraps into a rich dark soil. You keep the worms in an enclosed container, indoors or outdoors, and feed them your organic kitchen scraps, otherwise known as "garbage." The worms eat the "garbage," and produce an earthy-smelling, nutrient-rich humus, called worm castings. You can use the worm castings in your garden or houseplants to improve the soil.

Reduce your household's
trash 50% by
reusing,
recycling,
composting yard trimmings and
vermicomposting
kitchen scraps!!!

What are some of the benefits of vermicomposting?

(1) Reduce household trash.
Food scraps make up 8% - 11% of the waste stream, which in Durham is over 15,000 tons of food waste per year.

(2) Produce a high quality garden compost.
Worm castings, the product of vermicomposting, are a rich soil amendment sold in stores for up to $4.00 a gallon.

(3) No odor and low maintenance.
You can add your non-meat and non-dairy kitchen wastes to your compost pile in your backyard or you can compost these kitchen scraps in a vermicompost bin (worm bin). By using a worm bin to compost your food wastes you are less likely to attract vermin to your compost pile, you will have less odor, you will have lower maintenance and the worms break down your kitchen waste faster than allowing the micro-organisms in a compost pile to work on their own.

(4) A steady supply of fishing worms.

To Get Started, You Will Need:

1. An enclosed container. You can build a wooden box for your worms or you can buy a plastic container. The box needs a lid on it because the worms do not like light. The box should be about one foot deep. A 1' deep x 1' wide x 2' long container with a lid is usually adequate for a two person household. A container 1' deep x 2' wide x 3' long is suggested for families of 4-6. *The general rule of thumb is one square foot of surface area for each pound of garbage per week.*

Plastic or Wood? If you are going to be keeping your worm box outside, you will want a wood box. Wood has better insulation capacity than the plastic and will keep the box cooler in the summer and warmer in the winter. If you are going to be keeping the box indoors, then plastic or wood is fine. Some folks build their worm bins to also function as benches. SunShares has building instructions for wooden bins. Any plastic container the proper size with a lid will work. Make sure your box has holes in the bottom for drainage and holes on the sides for ventilation. If the worm bin does not get enough air, your worm bin will begin to have an odor.

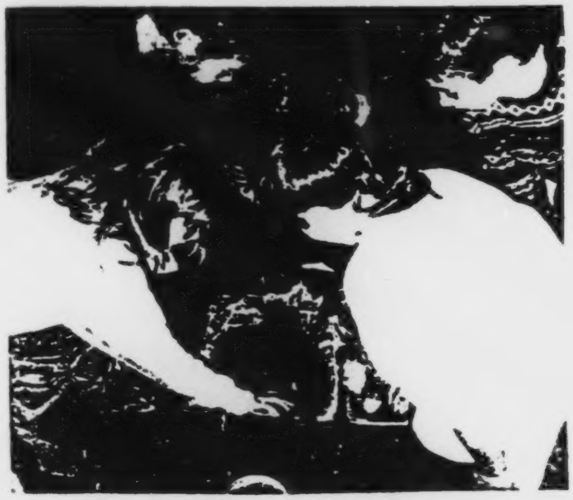


Photo courtesy of S. White, Co-editor, *Worm Digest*

SunShares 1215 S. Briggs Avenue, Suite 100 Durham, NC 27703 (919) 596-1870

2. **Bedding for the worms.** Worms need some material in the box to crawl around in. This could be shredded leaves, shredded newspapers, shredded corrugated cardboard, dirt, aged horse manure, peat moss or any combination of these. Light, fluffy material is best since this allows for ample air exchange. If you use only newspapers or corrugated cardboard, add a handful or two of soil to the bedding. The worms need some grit for breaking down food particles within the worm's gizzard.
How much bedding? For a 1' x 1' x 2' bin, you will want to use 2-3 pounds of dry bedding; for a 1' x 2' x 3' bin, you will want to use 9-14 pounds of dry bedding. After three to six months, all the bedding will be converted to worm castings.

3. **Moisture.** As with all composting, water is essential. The worms need a moist environment in order to breathe through their skin. If you use newspaper, corrugated cardboard or leaves as bedding, soak the bedding material in water for a few minutes, then wring it out as you would a sponge and fluff it up before adding it to the bin. For manure or peat moss beddings, you can add water to the bedding material to the desired dampness. You want the bedding to be very damp, but not soggy. If you squeeze the bedding, two to three drops of water should come out. You will want to monitor the moisture level in your worm bin, particularly if your bin is outside. In the summer, you may have to add water. The drainage holes should take care of excess moisture.

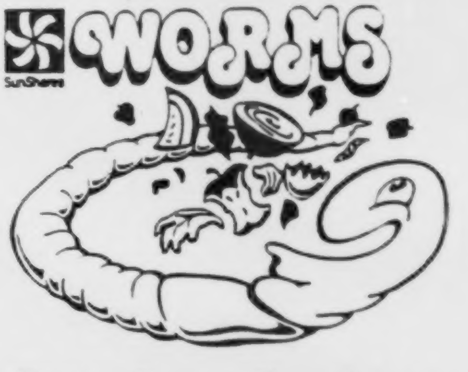
4. **Worms – the stars of the show!** It is important that you have the right kind of worms. The common nightcrawler will not work. Nightcrawlers like to make burrows. When you add the food scraps, you would disturb the burrows and eventually the nightcrawlers would die. You want to get red worms, also known as red wigglers. Their scientific name is *Eisenia foetida*. Listed on the back of this flyer are places you can buy red wigglers. You will need a worm:daily garbage ratio (: means "to") of 2:1. That is, if you generate a pound of garbage per day, you will need 2 pounds of worms in your bin. If you generate 1/2 pound of garbage per day, you will need 1 pound of worms.

5. **Where to place the worm bin?** If you are going to keep the worm bin outside, you will want it to be in the shade during the hot summer and sheltered from the cold during the winter (like a garage or carport). The worms can only survive temperatures of 55º - 77º F. However, a wooden worm bin will maintain a more constant temperature than the outside air. You will want the worm bin to be in a convenient place for you to feed.

Now that you have set up your worm bin, let the worms do the work...

Collect kitchen waste in any leak-proof, plastic or metal container. Simply dig a hole in the bedding, place the contents of your garbage bucket in the hole and cover with bedding. Cover well to decrease the chance of flies coming into the box. The worms will do the rest! You will want to rotate where you bury food scraps and keep track of what areas are "in use" by the worms. The worms will travel to the garbage and eat it leaving castings in their wake. Over time you will notice the bedding turning into a rich, dark, crumbly dirt -- your vermicompost!

Feed the Worms
- tea bags
- coffee grounds
- coffee filter
- crushed egg shells
- grains and breads
- fruit scraps
- vegetable scraps
- pasta
- plant clippings



Eat Our Garbage

Don't Feed the Worms
- meat
- bones
- grease
- cat or dog feces
- dairy products

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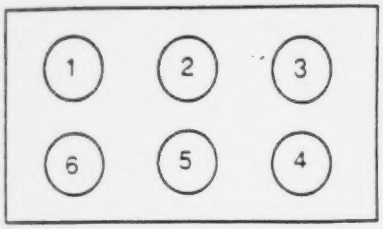
Rotation method of feeding:

Mark the last place you buried food with a stick or trowel so you know where to bury the food next.



By the time you get back to place #1, the food will have been eaten by your worms.

Some Common Questions

What happens if I overfeed my worms? Remember the general rule of thumb, *two pounds of worms needed for one pound of food per day*. If you overload the worm bin with food, it will become anaerobic (lack of oxygen) and odors will develop. If you do not bury food for awhile, the situation will correct itself. Likewise, you can underfeed the worms. If this happens, some of your worms will begin to die. If you don't see many worms, start feeding them more food and you will begin to see their numbers increase.

Should I grind the food scraps? Worms have very small mouth parts and will "eat" smaller pieces of food more quickly. However, grinding kitchen scraps is extra work and not necessary. Eventually even big pieces will be "eaten" by the worms. Large scraps such as broccoli stems should be cut into smaller pieces and egg shells should be crushed.

Do I need to hire a "wormsitter" when I go away? You can go away for a weekend, a week, even two weeks and not worry about your worms. Just feed them a little extra before you leave home. If you will be going away for a month or are leaving at a time when the temperature will drop or rise drastically, you will want to have someone check in on your worms.

If a worm is cut in half, will both parts grow back? Depending on where the worm was cut, it can grow a new tail. The worm cannot, however, regenerate a new head. This is why, when you bury your food scraps, be careful digging the hole. It is better to use a forked tool for burying food waste than a trowel.

Do worms die in the worm bin? Worms undoubtedly will die. They will reproduce. Red worms usually die within a year, although some have been known to live as long as four years. You will rarely see a dead worm because their bodies (75% water) quickly decompose. If large quantities of worms seem to be dying, you should attempt to determine the cause and correct the problem. Is it too hot? Did you stress the worms by adding too much salty food or acid-producing food? Is there adequate air flow through the bedding? You will have to make some guesses as to the problem. Sometimes, adding fresh bedding to a portion of the box is enough to correct the situation.

Should I buy breeders or pit-run worms? Either is fine. Breeders will lay cocoons more quickly and increase the number of individuals sooner, but they usually cost more. Pit-runs are generally cheaper and smaller. You will get more worms per pound. Pit-runs will grow rapidly and soon be able to reproduce.

As the worms reproduce, will I be overrun with worms? The population of worms in your box will stabilize at the number that can be supported by the amount of food they receive. If more are produced than you feed, some of the worms will get smaller, some will slow reproduction and some will die. If you take away some of your worms to give to a friend (a worm box with worms makes a great gift), your worms will reproduce and in a short time reach the number adequate for the size worm bin you have and the amount of food you are feeding them.

What are some of the other critters in my worm bin and should I be alarmed? Don't be alarmed if after your worm bin is established you find small insects present. Most of these will be "good bugs" and the majority are microscopic. They help break down the organic wastes. If you should be concerned about a strange bug, you can contact the Cooperative Extension Service to have it identified or call SunShares.

Will the worms try to escape? Your worms will never try to escape unless the worm bin overheats or there is too much moisture in the bin. Too much moisture will create an anaerobic environment, making the bedding turn sour.

How do I harvest the worm castings?

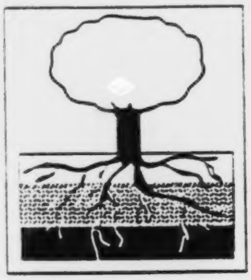
When all of the bedding is a dark brown crumbly material, your worm bin is ready to be harvested. You will need to empty the box about every three to six months. You can do this in one of two ways:

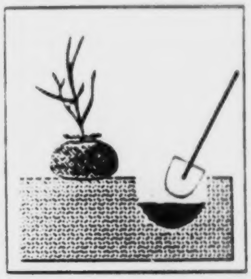
(1) Empty the box onto a large plastic sheet such as an old shower curtain. Do this on a sunny day or under a strong light. Once the compost is dumped onto the plastic sheet, wait about a half hour and then scrape off the top layer all around. The worms will continue traveling away from the light so that every half hour or so you can scrape off another layer of compost. Eventually after 6-8 scrapings, all the worms will be clustered in the center with wormless compost laying all around. Gather up the worm cluster, put it back in the worm box with fresh bedding and start all over again.

(2) Another way to harvest the vermicompost is to only feed the worms on one side of your worm box for several weeks. The majority of the worms will migrate to the side that you are feeding. You can then harvest the side that you haven't been feeding. You may still have a few worms in the compost. They won't hurt your garden. Add fresh bedding to the empty side and begin to only feed on that side, after several weeks, harvest the other side.

Mix the finished vermicompost into soil when preparing to plant.

Compost can be applied in a layer on top of the soil and worked-in.





Compost can be put directly in planting holes or potted plants.

Where do I get Red Worms?

Redworms are easily packaged and shipped through the mail or package delivery systems. When ordering, temperature extremes should be avoided. Usually growers will wait to send worms until the temperature is moderate. Worms from a bait dealer usually cost about twice as much as from a grower. Here are some sources for ordering worms:

Flowerfield Enterprises, 10332 Shaver Road, Kalamazoo, MI 49002, (616) 327-0108.
Good Earth Organics, WNC Farmer's Market, Box 15, Unit F, Asheville, NC 28806, (704) 252-4414.
E. H. Hobgood, Durham, NC 27712, (919) 477-5855.
Willingham Worm Farm, Route 1, Box 241 Butler, GA 31006, 1-800-223-WORM.

Recommended reading: *Worms Eat My Garbage* by Mary Appelhof (avail. from SunShares for $8.00).

Printed on 100% recycled paper with 35% post-consumer waste content.

Water Quality & Waste Management

Worms Can Recycle Your Garbage

North Carolina's estimated 420,000 tons of food waste are buried or burned each year at considerable financial and environmental cost. Instead of discarding your food scraps, you can recycle them with the help of worms. Vermicomposting (worm composting) turns many types of kitchen waste into a nutritious soil for plants. When worm compost is added to soil, it boosts the nutrients available to plants and enhances soil structure and drainage.

Using worms to decompose food waste offers several advantages:

- It reduces household garbage disposal costs;
- It produces less odor and attracts fewer pests than putting food wastes into a garbage container;
- It saves the water and electricity that kitchen sink garbage disposal units consume;
- It produces a free, high-quality soil amendment (compost);
- It requires little space, labor, or maintenance;
- It spawns free worms for fishing.

Equipment and Supplies

The materials needed to start a vermicomposting system are simple and inexpensive. All you will need are a worm bin, bedding, water, worms, and your food scraps.

Worm Bin. A suitable bin can be constructed of untreated, nonaromatic wood, or a plastic container can be purchased. If a plastic container is used, it should be thoroughly washed and rinsed before worms and bedding are added. The bin size depends on the amount of food waste produced by your household. For two people (producing approximately 3½ pounds of food scraps per week), a box 2 feet wide, 2 feet long, and 8 inches deep should be adequate. A 2-foot-by-3-foot box is suitable for four to six people (about 6 pounds of waste per week). Redworms (the type used for vermicomposting) thrive in moist bedding in a bin with air holes on all sides. For aeration and drainage, drill nine ½-inch holes in the bottom of the 2-foot-by-2-foot bin or 12 holes in the 2-foot-by-3-foot bin. Place a plastic tray under the worm bin to collect any moisture that may seep out. Keep a lid on the bin, as worms like to work in the dark. Locate the worm bin where the temperature remains between 55° and 77°F. (An indoor location is preferable.)

Bedding. The worms need bedding material in which to burrow and to bury the garbage. It should be a nontoxic, fluffy material that holds moisture and allows air to circulate. Suitable materials include shredded paper (such as black-and-white newspapers, paper bags, com-

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[redacted]

North Carolina
Cooperative Extension Service
NORTH CAROLINA STATE UNIVERSITY
COLLEGE OF AGRICULTURE & LIFE SCIENCES

puter paper, or cardboard); composted animal manure (cow, horse, or rabbit); decaying leaves; or peat moss (which increases moisture retention). Add two handfuls of soil to supply roughage for the worms. Adding crushed eggshells provides not only roughage but also calcium for the worms, and it lowers acidity in the bin. About 4 to 6 pounds of bedding is needed for a 2-foot-by-2-foot bin (for two people), and 9 to 14 pounds of bedding should be used in a 2-foot-by-3-foot bin (for four to six people).

Water. To keep bedding moist, add 3 pints of water for each pound of bedding. You will need about 1½ to 2¼ gallons of water for 4 to 6 pounds of bedding.

Worms. It is important to get the type of worms that will thrive in a worm bin. Only redworms or "wigglers" (*Eisenia foetida*) should be used (do not use nightcrawlers or other types of worms). Worms can be obtained from bait shops, nurseries, or by mail from commercial worm growers; the commercial growers are the most reliable source. Add 1 pound of worms to the 2-foot-by-2-foot bin or 2 pounds of worms to the 2-foot-by-3-foot bin.

Food Scraps. Feed your worms any nonmeat organic waste such as vegetables, fruits, eggshells, tea bags, coffee grounds, paper coffee filters, and shredded garden waste. Worms especially like cantaloupe, watermelon, and pumpkin. Do not add meat scraps and bones, greasy foods, fat, tobacco, pet waste, or citrus rinds.

Starting the Process

To start your vermicomposting system, first select a location for your worm bin, such as the basement, garage, or kitchen. Soak the bedding in a bucket overnight so that it is moist but not soggy. Place the bedding evenly into the worm bin and gently add the worms to the surface of the bedding. Keep the bin lid off for 1 to 2 hours so that the worms will move away from the light and burrow into the bedding.

Once the worms have settled into their new home, add food scraps. It is best to dig a hole in the bedding, place waste in the hole, and cover it with about 1 inch of bedding. Bury food scraps in a different area of the bin each time. Worms may be fed any time of the day. Do not worry if you must leave for a few days, as the worms can be fed as seldom as once a week.

Harvesting the Worms and Compost

In three to four months, your worms will have turned the food scraps and bedding into a dark, rich, soil-like material called *vermicompost*. This material can be mixed into the soil in your garden and around your trees and yard plants. It can also be added to potting soil for your houseplants.

To harvest the vermicompost, push all of the bedding to one side of your worm bin. Place new, moist bedding (half of the original amount of bedding) on the empty side, and add food scraps only to the new bedding. Within about four weeks, all of the worms will have moved into the new bedding and left finished compost on the old bedding side. Remove the compost and replace it with new bedding (half of the original amount). Now you can begin adding food scraps to both sides of the bin again. Repeat this process every three to five months.

Managing Your Worm Bin

Here are some other things you should know about your vermicomposting system.

- If too much food is added, the system can become overloaded and cause an odor. The odor will dissipate if you stop adding food until the worms catch up.
- Providing adequate oxygen and not too much moisture also minimizes odors.
- If fruit peels are buried completely, fruit flies will not be attracted to the bin.
- When worms reproduce, they create matchhead-sized cocoons. Do not disturb them.
- Do not use your worm bin as a cat litter box, and do not add dog or human manure to the bin.
- Do not be surprised to see other creatures in your worm bin, as they help break down the organic material. Most of the organisms will be too small to see, but you may spot white worms, springtails, pill bugs, molds, mites, and fruit flies.

Large-Scale Vermicomposting

Vermicomposting can take place wherever food scraps are generated or delivered. Worm composting bins can be found in classrooms, apartments, offices, and other commercial locations. Large-scale worm farms are found in some states, including California, Rhode Island, and Oregon. Worms even compost the food waste produced at the Seattle Kingdome stadium.

Classrooms and outdoor centers are especially nice settings for worm composting. Children of all ages enjoy classroom activities involving worms. Curricular materials for grades 4 through 8 may be found in a 232-page book entitled *Worms Eat Our Garbage*. Activities in the book can be used in a multitude of disciplines, including science, mathematics, geography, language arts (vocabulary, poetry, and prose), and music.

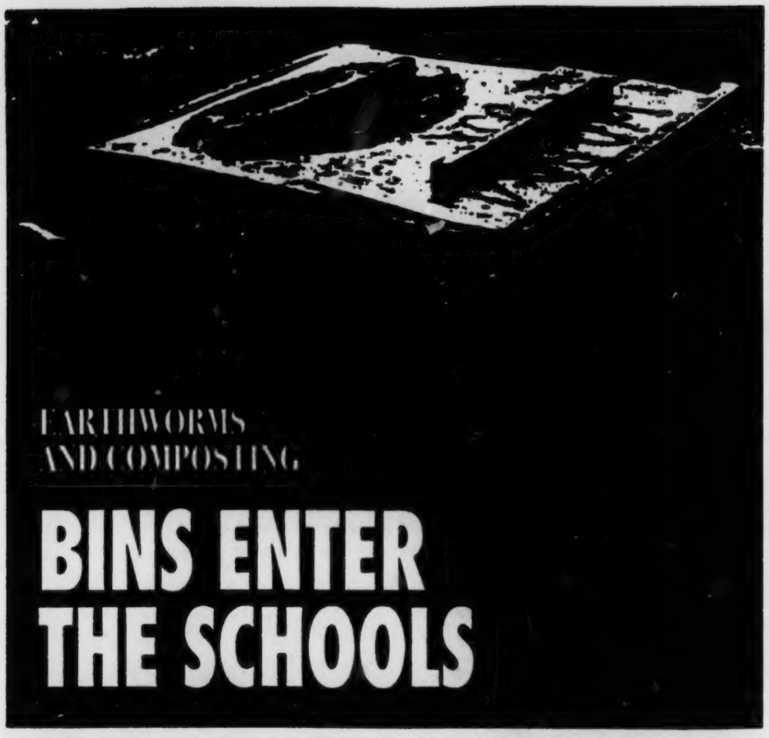

Photo by Mary Appelhof

Each class decorated its own worm bins at Cinnibar School in Petaluma, California.

EARTHWORMS AND COMPOSTING

BINS ENTER THE SCHOOLS

Classroom worm bins are used effectively and educationally throughout the United States.

Mary Appelhof

INNOVATIVE classroom teachers with experience in vermicomposting food scraps at the classroom level are extending their efforts to handle the larger quantities found in school lunchrooms and cafeterias. Examples of systems in use include lidded wooden bins ranging from 122 cm square to 122 cm by 244 cm, with height generally not exceeding 45 cm. The school children actively participate in constructing the bins, preparing the bedding, and weighing and introducing the residuals to the worm bins. As the well-fed worms increase in population, more bins are constructed to handle larger volumes.

Cinnabar Elementary School in Petaluma, California, under the guidance of Anita Latch, developed a vermicomposting project to compost lunchroom leftovers. Each classroom decorated its own 120 cm by 120 cm by 30 cm worm bin. The best beddings turned out to be decomposed wood chips. Remnants of school lunches supported a healthy population of *Eisenia foetida*. The fifth grade had major responsibility for the vermicomposting project. They kept the records, maintained the bins, and sold the worms. Students called local bait shops to line up a market for the worms. Proceeds from worm sales helped pay their way to Ecology Camp. Cinnabar School composted 727 kg of food scraps in six months.

Madison Middle School in Eugene, Oregon used in-ground worm bins constructed of concrete blocks with hardware cloth and wire mesh to prevent rodent access. Cafeteria scraps went into the worm bins, which were maintained by students of science teacher Robert Flow. They plan to use vermicompost on plants in the adjacent organic garden to produce food for the cafeteria.

$6,000 SAVINGS IN LAYTONVILLE

Binet Payne, Garden Director of Laytonville Elementary Schools in Laytonville, California, directed the school's vermicomposting program. Over 1636 kg of food scraps from the cafeteria were composted by worms during the 10 month, 1992-1993 school year. Four 120 cm by 240 cm by 30 cm worm bins constructed of redwood received about 22.5 kg of remnants per month. Bedding consisted of machine shredded construction paper and other nonrecyclable paper from the elementary classrooms.

Children used wheelbarrows to collect the paper from classrooms each week and transport it to the shed where the fifth graders supervised and helped with the shredding. Other students aerated the beds weekly by turning them over with flat-tined garden forks. Ms. Payne sought guidance and input from the children, the food services staff, administration, fellow teachers, custodial staff and the school board. People whose jobs were affected by the project helped define parameters and procedures.

Vermicompost went to the school garden which produced lettuce and other fresh vegetables for the cafeteria and guest lunches. The school avoided $6,000 in dumpster fees by not having to store, transport and landfill dozens of dumpster loads of food scraps and nonrecyclable paper. ■

Mary Appelhof is founder of Flowerfield Enterprises in Kalamazoo, Michigan, which published her book, Worms Eat My Garbage, and distributes an aerated plastic worm bin. This report is based on her presentation at the Fifth International Symposium on Earthworm Ecology.

RED WIGGLERS AS TEACHING TOOLS

TEACHING students about vermicomposting starts with some introductory slides and overheads about the composting process and the biology of red wigglers. The biology discussion covers the importance of moisture so oxygen exchange can occur through the skin, the importance of temperature, what to feed them, and some simple anatomy of the worm.

I discuss the rapid rate of reproduction of these organisms — from eight to 1,500 in six months. For the older youngsters from junior high on, I mention that each worm produces both sperm and eggs, a condition known as being hermaphroditic. At the end of the 15 to 20 minute talk, I put a red wiggler into each youngster's hand and ask them to name their wiggler. After five minutes, I collect the wigglers and ask each student the name they gave to their worm. By this time, any trepidation to the red wigglers has completely evaporated. I then leave some literature on how to care for them.

The wigglers need to be fed and the bedding kept moist. Bedding should be kept moist enough so that when squeezed, a couple of drops of water are squeezed out. To feed the worms, students bring back to class their fruit and vegetable scraps such as pears, peaches, apple cores, banana peels, carrot and celery sticks, and lettuce and put them in a large coffee can. Then, once a week, students add the scraps to the worm bin. The food needs to be buried several inches into the bedding to minimize odors and insect attraction. As time goes on, the youngsters see the scraps, such as a banana skin, disappear "like magic," says Ann Marie O'Connor, a teacher at Cicero Elementary School in Cicero, New York. "The kids are thrilled."

Three to five pounds each week of food scraps per class are recycled and kept out of the waste stream. With more classes participating in worm composting, a good deal of the school's residuals could be consumed.

Photo by Knowlton Foote

Fourth graders in Marcellus, New York won a state sponsored science and technology award for their worm bin to kenaf project.

A splendid activity using red wigglers was carried out by Julie Dermondy's fourth grade class at Driver Middle School in Marcellus, New York. Her class started out with my presentation in the fall, after which I left some red wigglers. For the worm bedding, the class initially used some office paper that had been torn in one-quarter inch wide strips. A handful of soil also was added to inoculate the bedding with bacterial spores. Fruit and vegetable scraps were added by the students once a week. After a three to four month period, vermicompost was created from the paper and food. This material was then used as a potting mixture to grow a fiber-rich plant called kenaf, *Hibiscus cannabinus* L., which can reach a height of 10 feet starting from seed in just five months. The kenaf plants were planted outdoors in a compost-rich soil which the students had helped create the previous fall. These plants were later used to make paper, which was then torn into strips for the redworm bedding. Thus a complete cycle evolved: worm bedding to worm compost to potting soil for kenaf plants to paper, and finally back to worm bedding again.

—Knowlton Foote

Knowlton Foote is a recycling specialist with the Onondaga County Resource Recovery Agency in North Syracuse, New York.

Sources of Additional Information and Supplies

Supplies

Flowerfield Enterprises, 10332 Shaver Road, Kalamazoo, Michigan 49002; telephone (616) 327-0108. Offers worms, bedding, bins, and books, including *Worms Eat My Garbage* (a guide to setting up and maintaining a worm composting system) and *Worms Eat Our Garbage* (a curriculum guide for school and outdoor centers).

Carolina Biological Supply, 2700 York Road, Burlington, North Carolina 27215; telephone (800) 334-5551. Offers worms, bedding, and bins.

The Worm Concern, 580 Erbes Road, Thousand Oaks, California 91362; telephone (800) 854-1244 or (805) 520-1150. Sells vermicompost, worms, bedding, bins, books, plants, mulch, natural pest predators, and other products.

Local Information Resources

North Carolina Cooperative Extension Service
Contact your county Cooperative Extension Center
or:
Department of Biological & Agricultural Engineering
North Carolina State University
Box 7625
Raleigh, NC 27695-7625
Attention: Rhonda Sherman
Telephone (919) 515-6770

North Carolina Office of Waste Reduction
P.O. Box 27687
Raleigh, NC 27611-7687
Telephone (919) 571-4100 or (800) 763-0136

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Reduce Reuse Recycle

7 ways to protect your family against pesticides in food

1. Wash all produce.
Washing fruits and vegetables in water may remove some surface pesticide residues; using a diluted solution of dishwashing soap and water may remove additional surface residues. Be sure to rinse well. Unfortunately, even careful washing may not remove all surface residues, and it can't remove pesticide residues that are contained inside the produce.

2. Peel produce when appropriate.
Peeling fruits and vegetables will completely remove surface pesticide residues. Remember, though, that peeling won't remove pesticide residues inside the produce, and that in some cases peeling may remove valuable nutrients.

3. Buy certified organically-grown fruits and vegetables.
You'll be accomplishing two things: You'll be feeding your family pesticide-free food, and you'll be sending supermarkets and growers the message that food laden with pesticides is unacceptable.

4. Buy domestically-grown produce in season.
Imported produce often contains more pesticides than domestically-grown produce, and may contain pesticides that are banned from use in the U.S. You can ask that your supermarket label produce for its country of origin, which should be easy to do since shipping containers usually identify the source of the produce.

5. Beware of perfect-looking produce.
Some pesticides are used simply to enhance the appearance of produce; flawless produce may signal that pesticides were used in growing it. A glossy surface may mean that the produce is waxed, and waxes can contain pesticides or may lock in surface pesticide residues.

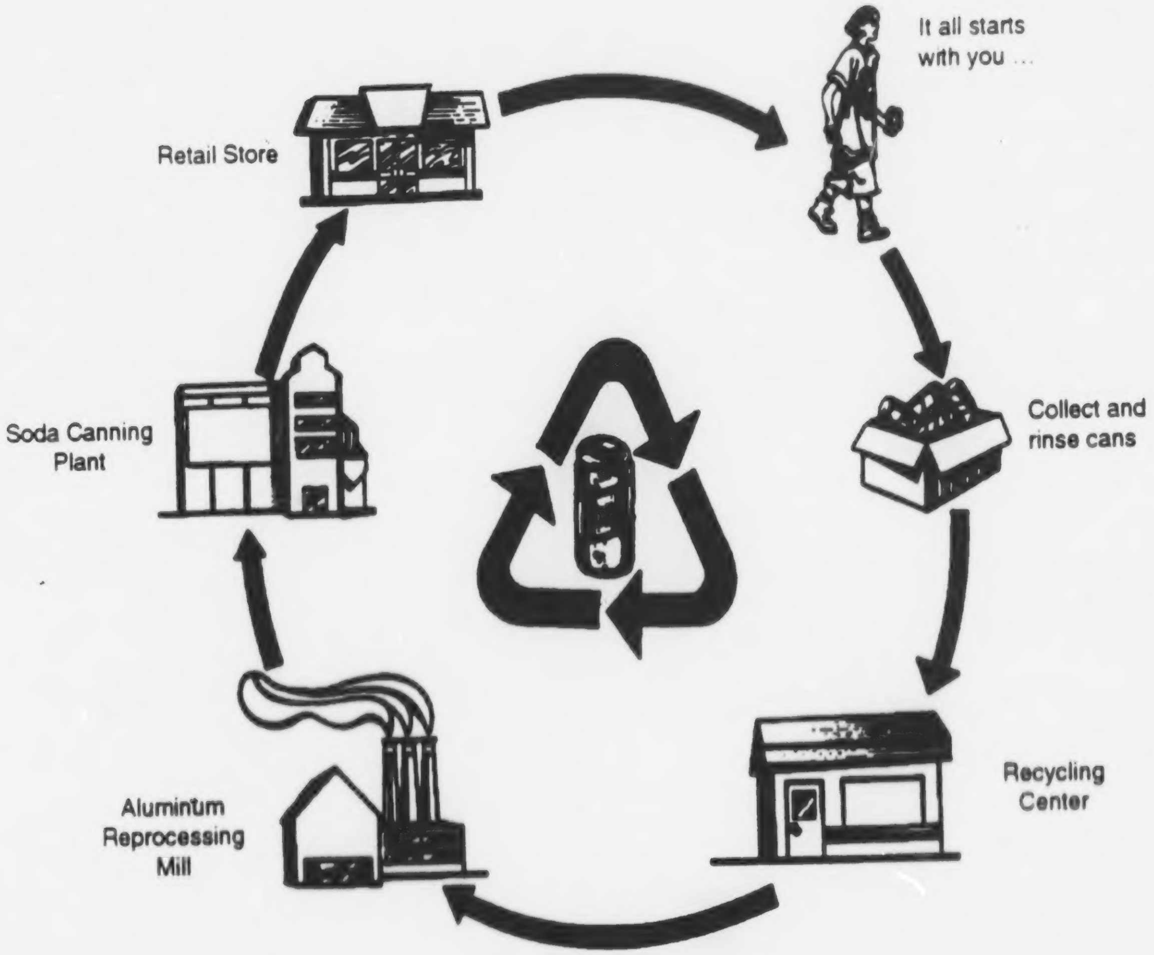
6. Grow your own produce if possible.
You can avoid the use of pesticides or use only the ones that have been thoroughly tested and found not to cause adverse health or environmental effects.

7. Write to your elected officials.
In the long-term, the best way to protect your family against pesticides will be through reforms in the way pesticides are regulated, and reductions in pesticide use.

Mothers and Others
FOR PESTICIDE LIMITS

A PROJECT OF THE
NATURAL RESOURCES DEFENSE COUNCIL

Recycle Cycle


It all starts
with you ...
Collect and
rinse cans
Recycling
Center
Aluminum
Reprocessing
Mill
Soda Canning
Plant
Retail Store

It all starts with You!

Enjoy the product ...

Rinse and place your empty can in recycle bin ...

See that items are taken to Recycling Center ...

The Recycling Center collects the cans and ships them to the aluminum mill where cans are reprocessed into useful aluminum that is made into cans or other aluminum items ...

Reprocessed cans go to the soda pop canning plant where they are filled again...

New packages of soda are delivered to the store, ready for you to buy them again!

FTC news

Federal Trade Commission *Washington, D.C. 20580*

FOR RELEASE: JULY 28, 1992

FTC CHAIRMAN STEIGER ANNOUNCES NATIONAL GUIDELINES TO PREVENT MISLEADING ENVIRONMENTAL MARKETING CLAIMS

The Federal Trade Commission today issued guidelines to help reduce consumer confusion and prevent the false or misleading use of environmental terms such as "recyclable," "degradable," and "environmentally friendly" in the advertising and labeling of products in the marketplace.

In announcing the guides at a Congressional hearing in Washington, D.C. this morning, FTC Chairman Janet D. Steiger said, "Our goal is to protect consumers and to bolster their confidence in environmental claims, and to reduce manufacturers' uncertainty about which claims might lead to FTC law-enforcement actions, thereby encouraging marketers to produce and promote products that are less harmful to the environment. I believe these guides, together with continued vigorous law enforcement by the FTC and the states, go a long way toward achieving these goals."

Steiger noted the extensive cooperation, expertise and support received from the U.S. Environmental Protection Agency in the guidelines project. EPA Administrator William K. Reilly expressed strong support for the FTC's decision today: "The Federal Task Force on labeling composed of EPA, FTC and the U.S. Office of Consumer Affairs has worked closely on the issue of environmental marketing. A primary goal of the Task Force has been to promote clear federal guidance to those who wish to make environmental claims. The FTC has today made a very significant contribution to that goal. The guidelines will help provide environmentally conscious consumers with more reliable information, ensuring the use of accurate, specific claims and discouraging those that are vague, trivial and overstated. We will see further environmental benefits as consumers use the formidable power of the marketplace to help achieve environmental goals. We applaud the FTC's decision today and are pleased we could assist the FTC in its efforts."

Ann Windham Wallace, Director of the U.S. Office of Consumer Affairs (USOCA), said, "Surveys show consumers are concerned about environmental issues. We are pleased the FTC has taken these concerns into account in developing its voluntary environmental

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marketing guides. We believe the guides will help consumers understand the basis for claims marketers may make, as well as enable consumers to make comparisons and choices based on criteria they believe is important."

The FTC received petitions to issue environmental guides from a number of industry members and trade associations. In addition, a task force of state Attorneys General recommended that the federal government issue uniform standards. The Commission also held two days of public hearings on whether the FTC should augment its case-by-case law enforcement with national guidelines. (The Commission has brought eight such law-enforcement actions in the last two years.) The vast majority of comments received from consumer and industry groups, environmental organizations, state and local governments, USOCA, and the EPA, supported the issuance of FTC guidelines.

A summary of the Environmental Marketing Guides immediately follows this news release. Generally, the guides focus on how consumers are likely to interpret various environmental claims, and identify types of claims that should be explained or qualified to avoid deceiving consumers. For example, broad environmental benefit claims, claims about benefits that will not occur if the product is disposed of in the customary way, or claims where it is not clear whether the benefit applies to the product or its packaging, should be explained or qualified, according to the FTC guides. Otherwise, marketers must be able to substantiate whatever interpretation reasonable consumers draw from those claims. The guides also illustrate the types of qualifications that can be made to avoid consumer deception.

The guides do not rigidly define environmental terms. Instead, through specific guidance and a series of examples of both acceptable and deceptive claims, the guides set out the different meanings that might be conveyed by the use or omission of particular language describing environmental features. The types of claims addressed by the guides include recyclable, degradable, compostable, recycled content, source reduction, refillable, and ozone safe.

The guides will be published in the Federal Register shortly. The guides are not, themselves, legally enforceable. They represent administrative interpretations of laws administered by the Commission to guide marketers in conforming with legal requirements. The guides do not preempt state or local laws or regulations. The Commission will request comments on how the guides are working after three years.

The Commission has prepared an environmental assessment of the guidelines, available to the public for review and comment for 30 days, until Aug. 27. The assessment concludes that an Environmental Impact Statement is not necessary because the guides themselves will not result in a "significant impact on the environment" -

under the applicable law. Comments should be addressed to the FTC, Office of the Secretary, 6th Street and Pennsylvania Avenue, N.W., Washington, D.C. 20580.

The Commission vote to issue the guidelines was 4-1, with Commissioner Mary L. Azcuenaga dissenting. In her dissenting statement, Commissioner Azcuenaga said, "As I read the law, the Commission has no authority to issue these guides, as written, without first employing [certain] rulemaking procedures . . . which it has not done." She believes that such procedures are necessary because the guides go beyond interpreting existing cases and policies and, in fact, constitute binding regulations. Commissioner Azcuenaga also said that she differs from the Commission in its decision not to place the guides on the public record for a short period of time to enable the public to comment on them.

Copies of the guidelines, the environmental assessment, Commissioner Azcuenaga's dissenting statement, and news releases on FTC cases in the green marketing area, are available from the FTC's Public Reference Branch, Room 130, at the above address; 202-326-2222; TTY 202-326-2502.

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MEDIA CONTACT: Bohnie Jansen, Office of Public Affairs
202-326-2161

STAFF CONTACT: Mary Koelbel Engle, Bureau of Consumer Protection, 202-326-3161

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SUMMARY OF FTC ENVIRONMENTAL MARKETING GUIDELINES

Background:

The Federal Trade Commission's Guides for the Use of Environmental Marketing Claims are based on a review of data obtained during FTC law-enforcement investigations, from two days of hearings the FTC held in July 1991, and from more than 100 written comments received from the public. Like all FTC guides, they are administrative interpretations of laws administered by the FTC. Thus, while they are not themselves legally enforceable, they provide guidance to marketers in conforming with legal requirements. The guides apply to advertising, labeling and other forms of marketing to consumers. They do not preempt state or local laws or regulations.

The Commission will seek public comment on whether to modify the guides after three years. In the meantime, interested parties may petition the Commission to amend the guides.

Basically, the guides describe various claims, note those that should be avoided because they are likely to be misleading, and illustrate the kinds of qualifying statements that may have to be added to other claims to avoid consumer deception. The claims are followed by examples that illustrate the points. The guides outline principles that apply to all environmental claims, and address the use of eight commonly-used environmental marketing claims.

General Concerns:

As for any advertising claim, the FTC guides specify that any time marketers make objective environmental claims -- whether explicit or implied -- they must be substantiated by competent and reliable evidence. In the case of environmental claims, that evidence often will have to be competent and reliable scientific evidence.

The guides outline four other general concerns that apply to all environmental claims. These are:

(1) Qualifications and disclosures should be sufficiently clear and prominent to prevent deception.

(2) Environmental claims should make clear whether they apply to the product, the package, or a component of either. Claims need not be qualified with regard to minor, incidental components of the product or package.

(Summary of FTC Environmental Marketing Guidelines)

(3) Environmental claims should not overstate the environmental attribute or benefit. Marketers should avoid implying a significant environmental benefit where the benefit is, in fact, negligible.

(4) A claim comparing the environmental attributes of one product with those of another product should make the basis for the comparison sufficiently clear and should be substantiated.

The guides then discuss particular environmental marketing claims. In most cases, each discussion is followed in the guides by a series of examples to illustrate how the principles apply to specific claims.

General environmental benefit claims. In general, unqualified general environmental claims are difficult to interpret, and may have a wide range of meanings to consumers. Every express and material implied claim conveyed to consumers about an objective quality should be substantiated. Unless they can be substantiated, broad environmental claims should be avoided or qualified.

Degradable, Biodegradable, and Photodegradable. In general, unqualified degradability claims should be substantiated by evidence that the product will completely break down and return to nature, that is, decompose into elements found in nature within a reasonably short period of time after consumers dispose of it in the customary way. Such claims should be qualified to the extent necessary to avoid consumer deception about: (a) the product or package's ability to degrade in the environment where it is customarily disposed; and (b) the extent and rate of degradation.

Compostable. In general, unqualified compostable claims should be substantiated by evidence that all the materials in the product or package will break down into, or otherwise become part of, usable compost (e.g., soil-conditioning material, mulch) in a safe and timely manner in an appropriate composting program or facility, or in a home compost pile or device. Compostable claims should be qualified to the extent necessary to avoid consumer deception: (1) if municipal composting facilities are not available to a substantial majority of consumers or communities where the product is sold; (2) if the claim misleads consumers about the environmental benefit provided when the product is disposed of in a landfill; or (3) if consumers misunderstand the claim to mean that the package can be safely composted in their home compost pile or device, when in fact it cannot.

Recyclable. In general, a product or package should not be marketed as recyclable unless it can be collected, separated, or otherwise recovered from the solid waste stream for use in the form of raw materials in the manufacture or assembly of a new product or package. Unqualified recyclable claims may be made if the entire product or package, excluding incidental components, is recyclable.

Claims about products with both recyclable and non-recyclable components should be adequately qualified. If incidental components significantly limit the ability to recycle product, the claim would be deceptive. If, because of its size or shape, a product is not accepted in recycling programs, it should not be marketed as recyclable. Qualification may be necessary to avoid consumer deception about the limited availability of recycling programs and collection sites if recycling collection sites are not available to a substantial majority of consumers or communities.

Recycled Content. In general, claims of recycled content should only be made for materials that have been recovered or diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer waste (post-consumer). An advertiser should be able to substantiate that pre-consumer content would otherwise have entered the solid waste stream. Distinctions made between pre- and post-consumer content should be substantiated. Unqualified claims may be made if the entire product or package, excluding minor, incidental components, is made from recycled material. Products or packages only partially made of recycled material should be qualified to indicate the amount, by weight, in the finished product or package.

Source Reduction. In general, claims that a product or package has been reduced or is lower in weight, volume, or toxicity should be qualified to the extent necessary to avoid consumer deception about the amount of reduction and the basis for any comparison asserted.

Refillable. In general, an unqualified refillable claim should not be asserted unless a system is provided for: (1) the collection and return of the package for refill; or (2) the later refill of the package by consumers with product subsequently sold in another package. The claim should not be made if it is up to consumers to find ways to refill the package.

Ozone Safe and Ozone Friendly. In general, a product should not be advertised as "ozone safe," "ozone friendly," or as not containing CFCs if the product contains any ozone-depleting chemical. Claims about the reduction of a product's ozone-depletion potential may be made if adequately substantiated.

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ANNOUNCING

THE NORTH CAROLINA ENVIRONMENTAL EDUCATION CLEARINGHOUSE

Office of Environmental Education
NC Department of Environment, Health, and Natural Resources

The Office of Environmental Education announces a new service, the *Environmental Education Clearinghouse*, mandated by the NC Environmental Education Act of 1993, to provide information about environmental education programs, resource experts, funding opportunities, materials and ideas. The mission is to serve as a resource for anyone with a question, need, or solution related to environmental education.

The *Environmental Education Clearinghouse* will serve both the users and the providers of environmental education information and resources. Users may include elementary, middle, high school, and college teachers, students, parents, business, industry and the general public. Providers of formal and informal environmental education programs and resources include state agencies, institutions of higher education, private organizations, business, industry and local government agencies.

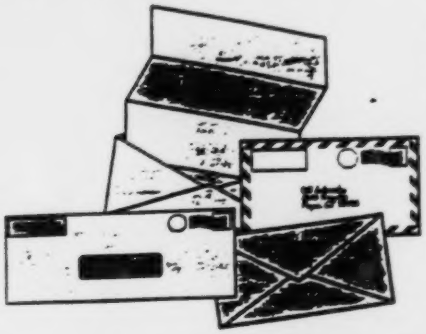
The *Environmental Education Clearinghouse* will provide information about teacher pre-service education and in-service professional development and internships in environmental education, as well as information about curricula, activities and materials that can enhance environmental education in formal or informal settings for K-16 students and for the general public. The *Teacher's Guide to Environmental Education Programs and Resources - 1995-96 Year of the Mountains edition*, and the *Guide to Environmental Education Centers in North Carolina* contain the kinds of information the *EE Clearinghouse* will deliver.

The *EE Clearinghouse* will develop and maintain a current list of contacts and resource individuals in environmental education who may be able to answer further questions or render additional assistance. And if you have questions about environmental education funding or career opportunities, the *EE Clearinghouse* may have the leads you need to accomplish your goals.

You may reach North Carolina's *Environmental Education Clearinghouse* via telephone at 800-482-8724 (local Raleigh number is 919-733-0711), or via Internet electronic mail at *ddubay@cgia.state.nc.us*. Our US Mail address is Environmental Education Clearinghouse, P.O. Box 27687, Raleigh, NC 27611-7687. An Internet World Wide Web home page is under development.

You may read about environmental education opportunities and resources highlighted by the *EE Clearinghouse* in a variety of existing newsletters. If you have any questions or would like further information, please give us a call, send us an e-mail, or drop us a card or letter. We'd like to hear from you.

Bulk Mail Reduction



Local governments may wish to promote a campaign that will help consumers reduce the amount of bulk mail or third class mail they receive and discard. As approximately 40% of all material destined for disposal is paper, a program that helps consumers to reduce the amount of a paper they receive can impact the amount they then discard. A survey conducted by the City of Greensboro showed that residents wanted to stop or reduce the amount of bulk mail they received but were uncertain how to do so.

Residents can write to several direct marketing associations to have their name removed from mailing lists. Local governments can publicize company names and their addresses to help residents reduce the amount of unwanted mail they receive.

Table 15. Direct Marketing Contacts
(Information compiled by Paul Dunn, Orange Community Recycling)

☐ Advo Inc.
Dir. of List Maintenance
239 W. Service Rd.
Hartford, CT 06120-1280

☐ Chris Courtemanche
National Demographics & Lifestyle
List Order Services
1621 18th St., Ste. 300
Denver, CO 80202-1294

☐ Donnelley Marketing
1235 North Ave.
Nevada, IA 50201-1419

☐ Equifax Options
Equifax Marketing Decision System
P.O. Box 740123
Atlanta, GA 30374-0123

☐ Mail Preference Service
Direct Marketing Association
P.O. Box 9008
Farmingdale, NY 11735-9008

☐ Metro Mail Corporation
901 W. Bond St.
Lincoln, NE 68521-3694

☐ R.L. Polk and Company
List Services Division
6400 Monroe Blvd.
Taylor, MI 48180-1884

☐ TRW-NCAC
Target Marketing Service Division
901 N. International Pkwy., Ste. 191
Richardson, TX 75081-2874

☐ Trans Union
Transmark Inc.
555 W. Adams St.
Chicago, IL 60661-3601

Example: Orange Community Recycling
The Orange Community Recycling Program created a "JUNK MAIL TERMINATOR" kit for distribution to residents to assist in reducing the amount of third class mail delivered to households. Information in the kit suggests that 44 percent of bulk mail received is never opened or read. The kit has been widely accepted by the public. The TERMINATOR kit explains bulk mail, makes suggestions on ways to reduce it, and encloses postcards, pre-addressed, to the eight largest mailing list brokers. (The kit lists the **new** address for the Mail Preference Service, Direct Marketing Association, P.O. Box 9008, Farmingdale, NY 11735-9008.)

Other programs may obtain the right to reproduce the "JUNK MAIL TERMINATOR" kit by paying a one-time fee of $25 to Orange Community Recycling Program. The fee includes the camera-ready originals and a cover page personalized for your program.

For more information, contact Orange Community Recycling, (919) 968-2788.

North Carolina - "Source Reduction... It's a Bare Necessity" 1995

Appendix
RESOURCES--SOURCES FOR FUNDING AND AWARDS PROGRAMS

School Level

- Local PTA/PTO
- School System Development Office
- Public Education Funds established to support the school system.

Local/Regional Level

- Municipal/County Budget Appropriations
- Keep North Carolina Clean and Beautiful School Beautification and Recycling Awards Program
  Keep North Carolina Clean And Beautiful (KNCCB)
  P.O. Box 10000
  Raleigh, NC 27605
  (919) 787-1693

State Level

- North Carolina Recycling Association Annual Awards
  The North Carolina Recycling Association
  7330 Chapel Hill Road, Suite 207
  Raleigh, NC 27607
  (919) 851-8444

- Solid Waste Management Trust Fund Grants
  North Carolina Department of Environment, Health,
  and Natural Resources
  Office of Waste Reduction
  3825 Barrett Drive
  Raleigh, NC 27609
  (919) 571-4100

- Project Tomorrow Awards
  North Carolina Department of Environment, Health,
  and Natural Resources
  Office of Environmental Education
  P.O. Box 27687
  Raleigh, NC 27611
  (919) 733-0711

Appendix
RESOURCES--RECOMMENDED CURRICULA AND EDUCATIONAL MATERIALS

Curricula

Actions for a Cleaner Tomorrow: A South Carolina Environmental Curriculum
Office of Solid Waste Reduction and Recycling
Department of Health and Environmental Control
2600 Bull Street
Columbia, SC 29201
(803) 734-5000

*"*Actions Speak!" (louder than words)*//Grades 6-8
Illinois Department of Energy and Natural Resources
Office of Recycling and Waste Reduction
325 West Adams Street
Room 300
Springfield, IL 62704
(217) 785-0310

**Adventures of the Garbage Gremlin: Recycle and Combat a Life of Grime*
Grades K-6
The U.S. Environmental Protection Agency
Public Information Center
401 M Street, SW
Washington, DC 20460
(202) 260-7751

**A-Way With Waste: A Waste Management Curriculum for Schools*
Grades K-12
Washington State Department of Ecology
4350 150th Avenue, N.E.
Redmond, Washington 98052
(206) 855-1900

Clean Streets-Clean Beaches
New Jersey Department of Environmental Protection
Division of Solid Waste Management
Office of Communications
CN414/401 East State Street
Trenton, NJ 08625
(609) 530-8593

Completing the Cycle-It's Up To You-Responsibility for the Environment!
Grades 4-8
Indiana Department of Education
Center for School Improvement and Performance
Office of School Assistance
Room 229, State House
Indianapolis, IN 46204
(317) 232-9141

A Curriculum Activities Guide to Solid Waste and Environmental Studies
Grades K-6, 7-12
Institute for Environmental Education
3200 Chagrin Boulevard
Cleveland, OH 44124
(216) 543-7303

Environmental Education/
Grades K-12
Kansas Department of Education
120 East 10th Street
Topeka, KS 66612
(913) 296-3851

**The 4Rs Project/*Grades K-12
Florida Department of Education
Office of Environmental Education
Turlington Education Center
325 West Gaines Street,
Room 224-C
Tallahassee, FL 32399
(904) 487-7900

**4th R Curriculum*
Grades K-5
City and County of San Francisco
Recycling Program
City Hall, Rm. 271,
San Francisco, CA 94102
(415) 554-6197

**Garbology- Recycling in Schools*
Grades 4-12
Environmental Media
PO Box 1016
Chapel Hill, NC 27514
(919) 933-3003

Garbage Reincarnation: Curriculum Guide
Garbage Reincarnation, Incorporated
P.O. Box 1375
Santa Rosa, CA 95402
(707) 584-8666

Here Today...Here Tomorrow: A Curriculum on Recycling, Energy, and Solid Waste/ Grades 4-8
New Jersey Department of Environmental Protection
Division of Solid Waste Management
Office of Communications
CN414/401 East State Street
Trenton, NJ 08625
(609) 777-4322

Learning About Waste Separation and Composting
Grades 9-12
Delaware Solid Waste Authority
P.O. Box 455
Dover, DE 19903
(302) 739-5361

**Let's Recycle*
Grades K-12
The U.S. Environmental Protection Agency
Public Information Center
401 M Street, SW
Washington, DC 20460
(202) 260-7751

Let's Reduce and Recycle: A Curriculum for Solid Waste Awareness
Grades K-6, 7-12
The U.S. Environmental Protection Agency
Public Information Center
401 M Street, SW
Washington, DC 20460
(202) 260-7751

Litter Control, Waste Management and Recycling Resource Unit
Grades K-6
Louisiana Department of Education
Secondary Education
P.O. Box 94064
Baton Rouge, LA 70804
(504) 342-1136

**Mobius Curriculum: Understanding the Waste Cycle*
Grades 4-6
Browning Ferris Industries
Incorporated (BFI)
PO Box 3151
Houston, TX 77253
1-800-234-8100

Mountaineer Pride/ Grades K-12
West Virginia Department of Natural Resources
1900 Kanawha Boulevard
Building 3, Room 732
Charleston, WV 25305
(304) 558-3381

Municipal Solid Waste Management
Grades K-12
The U.S. Environmental Protection Agency
Public Region 8 (8HWM-RM)
Suite 500
999 18th Street
Denver, CO 80202
(303) 293-1818

Oliver Otter
Grades K-2, 3-4
GDS, Inc.
P.O. Box 9698
Hickory, NC 28603
1-800-833-7312

Operation Waste Watch/ Grades K-6
Virginia Department of Environmental Quality
Division of Litter Control and Recycling
James Monroe Building
11th Floor
101 North 14th Street
Richmond, VA 23219
(804) 371-0044

**Oscar's Options*
Department of Environmental Management
State of Rhode Island
9 Hayes Street
Providence, RI 02908
(401) 277-6800

Project Clean S.W.E.E.P. (Solid Waste Environmental Education Program)/ Grades K-12
Iowa Department of Education
Bureau of Instruction and Curriculum
Grimes State Office Building
Des Moines, IA 50319
(515) 281-4418

**Project Learning Tree*
American Forest Foundation
Suite 320
1250 Connecticut Avenue
Washington, D.C. 20036
(202) 463-2472

Project S.A.V.E. (Student Awareness and Values of the Environment)
Department of Environment and Natural Resources
Joe Foss Building

523 East Capitol
Pierre, SD 57501
(605) 773-3151

Recycle Alaska Curriculum
Alaska Department of Environmental Conservation
Pollution Prevention Office
Suite 1334
3601 C Street
Anchorage, AK 99503
(907) 563-6529

Recycle Hawaii for Kids
Grades K-6,9-12
Recycling Association of Hawaii
162-B North King Street
Honolulu, HI 96817
(808) 599-1976

**Recycling Study Guide*
Wisconsin Department of Natural Resources
Bureaus of Solid Waste and Information and Education
PO Box 7921
Madison, WI 53707
(608) 249-0737

Re: Thinking Recycling/ Grades K-12
Department of Environmental Quality
Environmental Affairs Division
811 Southwest Sixth Avenue
Portland, OR 97204
(503) 229-6709

R.O.A.R.- Recycle Our Available Resources/ Grades 4-8
Illinois Department of Energy and Natural Resources
Office of Recycling and Waste Reduction
325 West Adams Street
Room 300
Springfield, IL 62704
(217) 785-0310

Reusable Math–(booklet and teacher's guide)/Grades 1-8
Pennsylvania Resources Council
P.O. Box 88
Media, PA 19063
(610) 363-1555

School Activities Guides
Grades K-3,4-6
Spokane Regional Solid Waste Disposal Project
W. 808 Spokane Falls Boulevard
Spokane, WA 99201
(509) 456-7403

The Solid Waste Management Guide for Massachusetts Schools
Grades K-12
Mass. Dept. Environmental Protection, Div. Solid Waste Mgmt.
1 Winter Street
Boston, MA 02108
(617) 292-5988

Super Saver Investigators
Grades K-8
Ohio Dept. of Natural Resources
Division of Litter Prev./Recycling
Fountain Square, Building F-2
Columbus, OH 43224
(614) 265-6333
Teacher's Resource Guide for Solid Waste and Recycling Education
Grades K-12
Association of Vermont Recyclers
P.O. Box 1244
Montpelier, VT 05601
(802) 229-1833

**Think Earth Environmental Education Program*

Grades K-6
Educational Development
Specialists
Think Earth Customer Service
Suite 250
5505 East Carson Street
Lakewood, CA 90713
(310) 420-6814

Trash for the Long Haul
Grades K-12
Missouri Department of Natural
Resources
Division of Environmental Quality
P.O. Box 176
Jefferson City, MO 65102
(314) 751-3131

**Trash Monster and the Wizard of*
Waste
California Solid Waste Management
Board
Environmental Education Program
1020 9th Street, Suite 300
Sacramento, CA 95814
(916) 322-2684

Trash Today, Treasure Tomorrow
Grades K-6
Governor's Recycling Program
Office of State Planning
21/2 Beacon Street
Concord, NH 03301
(603) 271-1098
**Waste: A Hidden Resource*
Grades 7-12
Keep America Beautiful
West Broad Street
Stamford, CT 06902
(203) 323-8987

Waste Away: Information and
Activities for Investigating Trash
Problems and Solutions/ Grades 5-6

Vermont Institute of Natural Science
(VINS)
P.O. Box 86, Churchill
Woodstock, VT 05091
(802) 457-2779

**Waste In Place*
Grades K-6
Keep America Beautiful
West Broad Street
Stamford, CT 06902
(203) 323-8987

Waste Information Series for
Education (W.I.S.E.)
Grades K-12
Michigan United Conservation Club
P.O. Box 30235
Lansing, MI 48900
(517) 371-1041

Waste Reduction Guide
Grades K-12
Indiana Department of Education
Center for School Improvement and
Performance
Office of School Assistance
Room 229, State House
Indianapolis, IN 46204
(317) 232-9141

The Waste Stream/Grades 5-6
4-H Youth Development
Room 114-AGH-East Campus
University of Nebraska
Lincoln, NE 68583
(402) 472-2805

What A Waste! Grades K-6, 7-12
Minnesota Office of Waste
Management
Waste Education Clearinghouse
Suite 201

1350 Energy Lane
St. Paul, MN 55108
(612) 649-5482
1-800-877-6300

What A Waste!! Grades 3-6
Southwest CT Regional Recycling
Operating Committee
(S.W.E.R.O.C.)
125 East Avenue-Room 225
Norwalk, CT 06856
(203) 852-0103

Educational Packets and Kits

**Education Package on Marine Debris*
Marine Debris Information Office
NOAA/Center for Marine
Conservation
312 Sutter Street, Suite 316
San Francisco, CA 94108
(415) 391-6204

The Great Glass Caper
Glass Packaging Institute
Suite 800
1627K Street, NW
Washington, DC 20006
(202) 887-4850

**Mister Rogers: Activities for Young Children About the Environment and Recycling*/guide and video
WQED
Marketing Department Family
Communications, Inc.
4802 Fifth Avenue
Pittsburgh, PA 15213
(412) 687-2990

School Recycling Programs
A Handbook for Educators
The U.S. Environmental Protection
Agency
Public Information Center
401 M Street, SW
Washington, DC 20460
(202) 260-7751

The Tin Can Papermaking Project
Greg Markin Incorporated
P.O. Box 183
Appleton, WI 54912
(414) 734-9678

Yakety Yak - Take It Back Program
Take It Back Foundation
111 North Hollywood
Burbank, CA 91505
(818) 569-0552

Videos

"Aluminum Recycling: Your Next Assignment"
Aluminum Recycling Association
1000 16th Street, NW Suite 1200
Washington, DC 20036
1-800-243-6877

**"Full Circle"...*
Grades 6-12
The video is available for loan from
the North Carolina Department of
Public Instruction Tape Library;
Media and technology, NCDPI,
Raleigh, NC 27601 (919) 715-1549

**"GO"*
Dowling-Shephard Productions
Bullfrog Films
Oley, PA 19547
1-800-543-FROG

*"*Mystery of the Cast-Off Capers*"
Grade 5
North Carolina Cooperative
Extension Service
North Carolina State University, Box
7625
Raleigh, NC 27695
(919) 515-6770

**"Pass it On"*
(Starring Muggsy Bogues)
Mecklenberg County
Solid Waste Management
Media Contacts
700 North Tryon Street
Charlotte, NC 28202
(704) 336-3777

*"*3-2-1 Contact Rotten Truth*"...(elementary school)
WINGS for Learning
1600 Green Hills Rd
P.O. Box 660002
Scotts Valley, CA 95067-0002
Space Station Earth
Grades 4-5
Snohomish County Solid Waste Department
County Administration Building
2930 Wetmore
Everett, WA 98201
(206) 388-3425

1-800-321-7511

Software

National Geographic's Kids Network
National Geographic Society
Educational Services
P.O. Box 98018
Washington, DC 20090
1-800-368-2728

Trash Goes to School
Cornell University Audio-Visual
Library
8 Business and Technology Park
Ithaca, NY 14850
(607) 255-2091

* Indicates curricula used and rcommended by various solid waste educators in North Carolina.
Note: Many materials and videos may be available on loan from your local Cooperative Extension agent, KAB representative, and recycling coordinator.

Beyond Recycling:
A Waste Reduction
Manual for Schools

As the title ***Beyond Recycling: A Waste Reduction Manual for Schools*** suggests, this manual demonstrates how schools can help ease the growing solid waste problem by reducing the amount of waste produced in the first place. Recycling is one good method for reducing solid waste but it is not the only option. This manual provides examples of schools that have gone beyond recycling incorporating source reduction, reuse, and composting, and recycling into an integrated solid waste management approach to waste reduction.

THE MANUAL INCLUDES:

- Case studies of seven North Carolina School and School System waste reduction programs;
- Step-by-step guidance for setting up a school-based waste reduction program;
- A resource section including a list of recommended solid waste education curricula and publications, a reference list of organizations to contact for additional information, and sources of funding and awards programs;
- A glossary of terms common to the solid waste field.

Beyond Recycling:
A Waste Reduction Manual for Schools

FREE from the North Carolina Office of Waste Reduction!
Return this request to receive your copy.

Name: ______________________________

Affiliation: ______________________________

Address: ______________________________

City: ______________ State: ______________ Zip: ______________

Phone: ______________________________

Send this request to: Beyond Recycling, NC Office of Waste Reduction
P. O. Box 29569, Raleigh, NC 27626-9569

STEEL RECYCLING INSTITUTE

A Few Facts About Steel -- America's Most Recycled Material

Steel Can Recycling

Magnetic separation makes steel cans easy to recycle. Installed at material recovery facilities and resource recovery plants, magnetic separation ensures reclamation of steel cans and other steel items for shipment to end markets.

- Steel cans, including food, paint and aerosol cans, were recycled in 1994 at a rate of 53 percent.
- In 1994, the steel industry recycled more than 17.6 billion steel cans, or enough cans to stretch around the equator more than 33 times.
- More than 170 million Americans have convenient access to steel can recycling through curbside, drop-off and buyback programs, as well as through magnetic separation at resource recovery facilities.
- If every American recycles at least 95 of the average 144 steel cans used each year, the steel industry will reach its goal of a 66 percent recycling rate for steel cans by year-end 1995.

Part of the Steel Industry's Overall Recycling Efforts

Steel can recycling is only a portion of the steel industry's overall recycling efforts. Annually, millions of tons of steel scrap from appliances, automobiles and other used steel products are remelted to produce new steel. In fact, for the first time in several years, the overall recycling rate for steel increased from 66 percent to 68 percent in 1994.

- Appliance recycling continues to grow. In 1994, 38 million appliances were recycled in the United States, at a rate of 70.2 percent.
- The more than 1.9 million tons of steel recovered through appliance recycling in 1994 would yield the equivalent amount of steel needed to build 174 new stadiums the size of Cleveland's Jacobs Field.
- In 1994, the steel industry automobile recycling rate was 95.2 percent, meaning the industry recycled enough steel from old cars to produce almost 13 million new automobiles.

Preserving Energy and Natural Resources

Recycling programs are established primarily to reduce the solid waste stream. Besides saving landfill space, recycling steel saves valuable energy and natural resources.

- Each year, steel recycling saves the energy equivalent to meet the electrical power needs of Los Angeles for more than eight years.
- For every pound of steel recycled, 5450 Btu of energy are conserved, enough to light a 60-watt light bulb for more than 26 hours.
- Every ton of steel recycled saves 2500 pounds of iron ore, 1000 pounds of coal, and 40 pounds of limestone.

Today's Steel is Tomorrow's Steel

Recycling is an integral part of the steelmaking process. In the last 50 years, more than 50 percent of the steel produced domestically has been recycled. Today, the two types of furnaces used by the steel industry require "old" steel to produce "new" steel.

- Every time you buy something made of steel, you buy recycled.
- Steel cans and other steel products produced domestically contain at least 25 percent recycled steel, with some containing nearly 100 percent recycled steel.

BEST COPY AVAILABLE

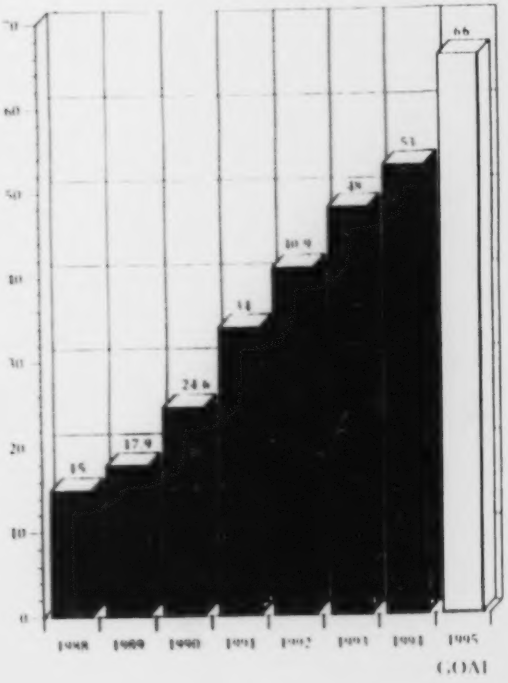
Call the Steel Recycling Institute's national consumer hotline, 1-800-YES-1-CAN (937-1226), to find the nearest location to recycle steel cans or appliances, or to order free information about steel can recycling.

Steel Recycling Institute • 680 Andersen Drive • Pittsburgh, PA 15220-2700 • 800/876-7274

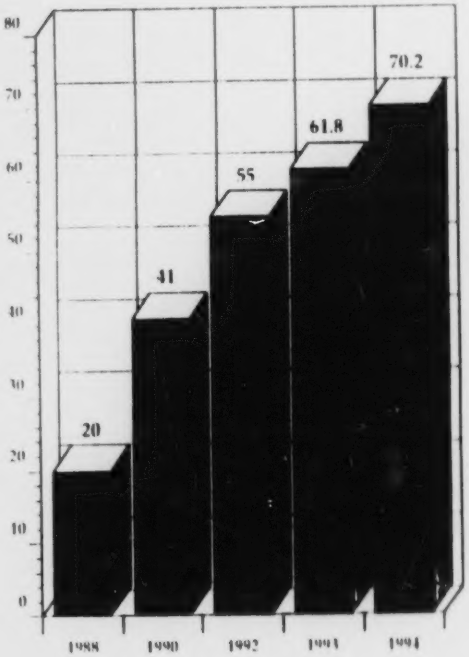
STEEL PRODUCT RECYCLING RATES

(All Recycling Rates By Percent)

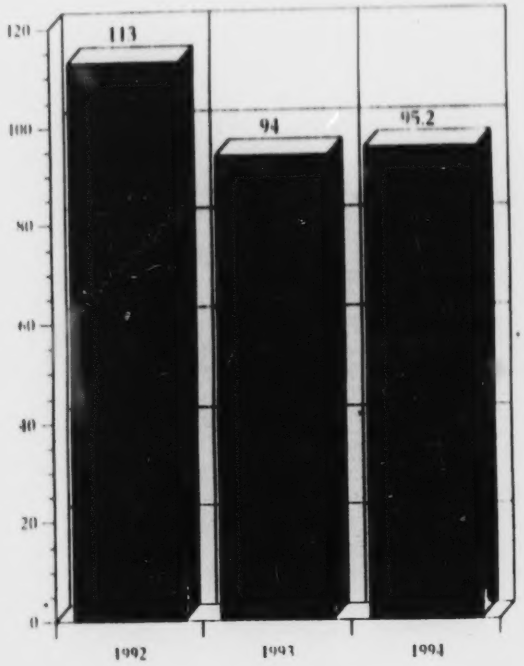
STEEL CAN RECYCLING RATE



APPLIANCE RECYCLING RATE



AUTOMOBILE RECYCLING RATE



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REAL-WORLD READING/REAL-WORLD ISSUES CONNECTING *STEEL TODAY* WITH CLASSROOM LEARNING

A Steel Cycles Educational Supplement
from the Steel Recycling Institute
(Including a "Did You Know?" poster/order form, Dockside Recycling Brochure and Fact Sheet)

Steel Today was developed as an insert for the April 11, 1995 edition of USA Today. Although this insert focuses on steel–the Enviro*metal*–the Steel Recycling Institute (SRI) encourages the study and recycling of all materials including paper, plastic, glass and aluminum. Many of these suggested activities can be applied to various materials for a more comprehensive understanding of solid waste management.

Ideas for connecting the *North American Steel Today* insert, as featured in USA Today, to classroom learning are as follows:

LEAD STORY

Economics, Environment Make Steel USA's Number One Recycler:

- Social Studies: Have students trace the history of the steel industry noting its important contributions in the following areas: Transcontinental Railroad, the building of skyscrapers and modern cities, the birth of unions, the role of steel recycling in America's war efforts and the resurgence of American steel companies. How has recycling played a role in the steel industry over the last 100 years? What role might recycling play over the next 100 years?

- Science & Technology: Based on the italicized quote, trace the steelmaking process from the mining stages, through the inherent recycling stages, to final production. Estimate the amount of energy and resources needed to produce one million tons of steel using a basic oxygen furnace. *"For more than 100 years, the steel industry has recycled because, for steel, recycling is smart business. Using scrap steel to make new steel lowers a variety of costs in the process and energy use is reduced by 75 percent."* (See also *Steel Shapes Our Lives* for more information on the basic oxygen furnace.)

- For another challenge, research a second method utilized for steelmaking, the electric arc furnace, and discover the technology behind producing virtually 100 percent recycled steel.

FRONT PAGE

Steel Shapes Our Lives:

- Home Economics: Have students imagine what life was like before steel products. What was transportation like before there were cars? How was food preserved and shopped for before steel refrigerators and freezers became common place? How do steel food cans fit into our daily lives?

SteelFile 1995

CANpaign '95:

- Home Economics: The Steel Recycling Institute has issued a challenge; if all Americans recycle 95 steel food cans in 1995, then the SRI will reach its goal of a 66 percent recycling rate. Photocopy the *Make Recycling Count* chart on the back page of the *Steel Today* insert. Challenge students to complete this real-life project at home. Also, if your school has a full service cafeteria, steel food cans are being used. Enclosed in this packet is the SRI's Dockside Recycling brochure which outlines the process for preparing steel food cans, as found in school cafeterias, for recycling. Pass this brochure on to your cafeteria manager, and encourage the recycling of steel cans and other materials in your school.

Michigan Says "Yes" to Aerosols:

- Language Arts, Visual Arts, and Social Studies: Michigan is leading the way in recycling empty steel aerosol cans. Recycling aerosol cans is one way to generate needed scrap steel for the steelmaking process; yet, some communities are not aware of this resource. As a means of public service, have students generate art work and supporting literature concerning aerosol can recycling which they can distribute to community members and local and state officials.

APPLIANCES

Appliance Industry Plugged Into Recycling:

- Mathematics: The current recycling rate for major steel appliances is 70.2 percent. The SRI's goal for the year 2000 is to reach 80 percent. Assuming that a two percent rate increase will occur during each of the five remaining years, calculate how many appliances will need to be recycled each year to reach this goal.

States Put The Deep Freeze On Appliance Dumping:

- Social Studies and Language Arts: According to this article, "...20 states... have banned future disposal of appliances in landfills," (and) "...several states... have appliance recycling rates estimated at more than 70 percent." Have students research whether or not their state is one of the 20 states banning appliance landfilling and have them report on appliance recycling options in the community.

AUTOMOBILES

Your First Love Was Reincarnated & Steel Helps Automotive Industry Lose Weight:

- Science and Technology: These articles outline both the remarkable success of recycling steel from automobiles and the future challenge of the automobile industry to design cars which can be more fully recycled. According to the article, *Lose Weight*, "Experts estimate that the average junker in the year 2000 will include 570 pounds of nonmetallic material, much of which will have to be landfilled, some as hazardous waste." This leftover material is known as "fluff." Have students design a car with more recyclable parts. Help the students brainstorm what the leftover "fluff" may consist of. How might this "fluff" be more efficiently recycled, reduced or reused? Research how many years the steel from cars has been recycled.

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North America's Steel

USA-100 5/95 *Printed on recycled paper with soy-based ink.*

YES I CAN!

...a recycling video sponsored by the Steel Recycling Institute as part of the Steel Cycles education program.

Children and adults alike will enjoy this animated tale of a juice can, hot sauce bottle and daily newspaper, as the characters make their way from a smelly trash can to their ultimate destination...the grocery store shelf after being recycled into new products.

The video is intended for grades K - 3, but can be applied more broadly. The accompanying educators' guide reviews important points from the video, provides discussion questions and shows examples of hands-on activities. The complete guide fits inside the video sleeve.

Since the videotape was created through the city of Long Beach, it is copyrighted by the city, and residents in the cities of Long Beach, Lakewood or Signal Hill must contact the Long Beach solid waste management office to obtain a copy of the video.

Yes you can...and so can students...join the lovable characters in this story to learn more about solid waste management and recycling.

YES I CAN!
ORDER FORM

The price for the **YES I CAN!** video and educators' guide is **$10.95 per set** which includes U.S. postage. (Pennsylvania residents add six percent sales tax; Allegheny County, PA residents add seven percent sales tax.) Please allow four weeks for delivery.

I would like to order ______ set(s) of **YES I CAN!**

Send payment with order unless an invoice is required.
Make checks payable to: Steel Recycling Institute.

Name: ____________________
School/Organization: ____________________
Address (no P.O. boxes): ____________________
City: ____________ State: ____________ Zip: ____________
Phone: ____________________

Return this form to: **YES I CAN!**, Steel Recycling Institute
680 Andersen Dr., Pittsburgh, PA 15220-2700

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YIC-OF 8/94

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DON'T THROW AWAY A GOOD THING!

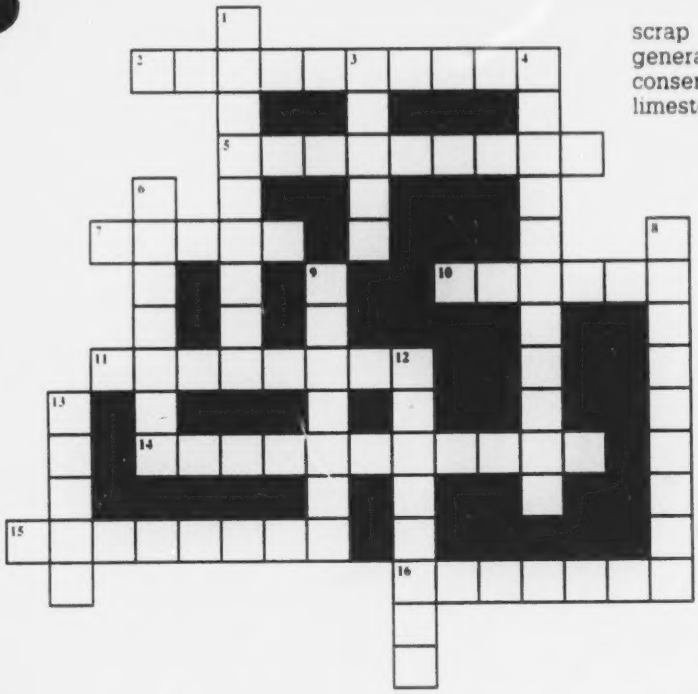
ACTIVITY ONE

Hi! I'm ROSCOE the steel spokescan with bad news and good news. First, the bad news. Since there are more people in the world than ever before, there's also more garbage. When we throw away our garbage, it doesn't really go away. It's usually taken to large areas called landfills. But these landfills are filling up. Each year, there's less space for our garbage—and for us!

Now for the good news. We can recycle what we no longer need. Recycling means a product is used, collected, processed and used again to produce a new product. When we recycle our renewable resources, we have more land, use less energy and help to save our environment.

When it comes to recycling, nothing works better than products made of steel. Steel is 100% recyclable! One steel product (like a can) is used to make another steel product (like a toaster), with nothing left over to be thrown away. Steel is easy to recycle because it can be separated from other materials with a magnet. By reusing steel, we save space and energy and conserve our natural resources for future generations.

Do you think you're a recycling expert? Find out by completing the crossword puzzle with words from the list below. See how much you really know about steel and recycling.



scrap
generations
conserve
limestone
natural
recycle
environment
steel
landfill
pollution
processing
magnetic
garbage
renewable
scarce
waste

Across

2. A magnet is used to separate steel from other materials for future ____________ into other recyclable steel products.
5. Steel is made from iron ore, coal and ____________.
7. Using steel products helps to eliminate ____________.
10. If we are not careful, our mineral supply will become ____________.
11. Steel is easy to recycle because it is ________.
14. We should all work to improve our ________.
15. Most trash is taken to a ____________.
16. We ____________ a product to make a new product.

Down

1. Recycling helps to reduce ________.
3. ________ is 100% recyclable.
4. We can make the world better for future ________.
6. Don't throw recyclable products in the ______ ______.
8. ____________ materials can be used over and over again.
9. Recycling helps to save our ________ resources.
12. We should ______ our irreplaceable resources.
13. We can recycle ____________ metal.

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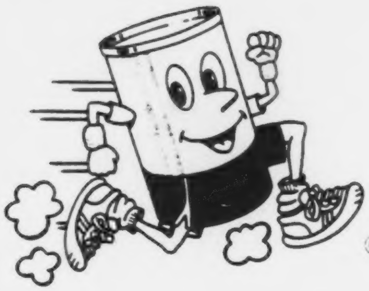
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YOU CAN DO IT WITH STEEL

ACTIVITY TWO

I don't mean to boast, but of all the wonderful steel products you use, the most popular is **Me**—the steel can. You've been using steel cans all your life and you probably call us "tin" cans. No matter! Whatever you call me, I'm the safest, strongest, most secure way to package fresh food.

How much do you know me? Test your "can of knowledge." Start by reading the statements below. Then check a box for each to show whether you agree or disagree with the statement. If you disagree, rewrite the statement correctly on the back of this sheet. Go ahead. *You* **can** do it!

	AGREE	DISAGREE
1. Steel cans are physically stronger than cans made from other metals.	______	______
2. Steel cans are microwaveable.	______	______
3. Small amounts of aluminum are helpful in the steelmaking process.	______	______
4. Recycled steel cans are only used to produce new steel cans.	______	______
5. The nutritional levels of steel canned foods are considerably less than those of fresh food.	______	______
6. Some easy-open can ends are now made from steel.	______	______
7. American consumers use about 100 million steel cans each day.	______	______
8. A steel can will eventually degrade into coal if exposed to the natural elements.	______	______
9. Aluminum is used as a coating for steel food and beverage cans.	______	______
10. The steel can is the basic container for about 1500 different food items and combinations.	______	______
11. Paint and aerosol cans, when empty and dry, are just as recyclable as steel food and beverage cans.	______	______
12. Most of the approximately 100 million steel cans used by Americans each day are recyclable.	______	______
13. Steel beverage cans are often called "bimetal" cans because the body is of steel and the top is made of limestone.	______	______
14. Recycling requires that labels and ends be removed from steel cans.	______	______
15. All steel cans contain some recycled scrap.	______	______

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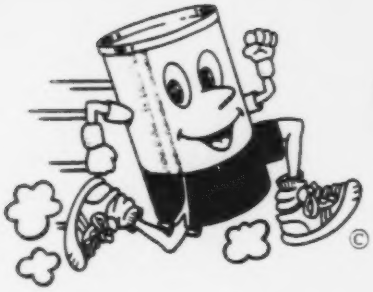


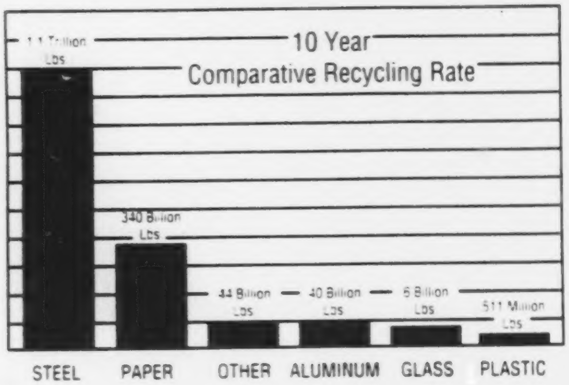
STEEL: THE COST CONTAINER

ACTIVITY THREE

Face the facts: Recycling is great for our economy, as well as our environment—and steel is our most recycled material.

People say numbers don't lie, so I've put together some figures about steel recycling to prove my point. There's one little problem—I'm a can, but I'm not uncanny. And I'm definitely not a mathematician! I need your help to find the answers to some questions.

First, look at the graph below. It compares recycling rates for some different materials over a 10-year period (1979-1988). Then use the facts shown on the chart to answer questions 1 and 2.



Circle the correct answer to each question below.

1. Between 1979 and 1988, approximately how much steel was recycled compared to paper?
   A. 1/3 as much C. 2 times as much
   B. 1/2 as much D. 3 times as much

2. What was the approximate total recycling weight of all the products—except steel—listed?
   A. 340 billion Lbs. C. 950 billion Lbs.
   B. 430 billion Lbs. D. 1 1/2 trillion Lbs.

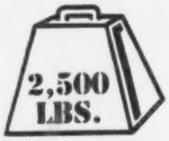
Write in answers to the following questions.

3. In the last decade, steel recycling has extended the life of the nation's landfills by more than three years. At that rate, how many years can we expect the nation's landfills to be extended from this year to the year 2030? ________________

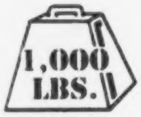
4. The overall recycling rate of steel products in the United States is 66%—the highest rate of any material. If we start with 500 tons of steel, how much is likely to be recycled? ________________

5. At current prices, steel recycling saves America more than $2 billion each year in solid waste disposal costs. At this rate, what will the savings be in 5 1/2 years? ________________

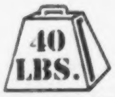
Every ton of recycled steel cans (the average annual consumption of 20 households) saves:



IRON ORE



COAL



LIMESTONE

Use this information to answer questions 6 and 7.

6. How much iron ore, coal and limestone is saved with 25 tons of recycled steel?
Iron Ore: __________ Coal: __________ Limestone: __________

7. If enough steel is recycled to save 120 pounds of limestone, how much iron ore and coal will also be saved?
Iron Ore: ________________ Coal: ________________

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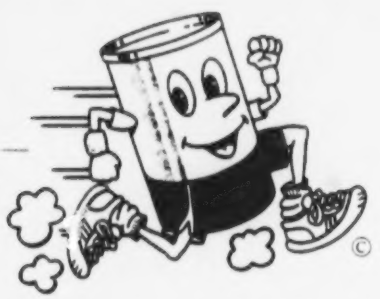


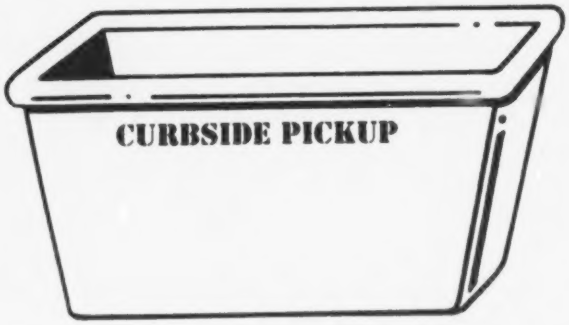
GET ON THE RECYCLE ROLL

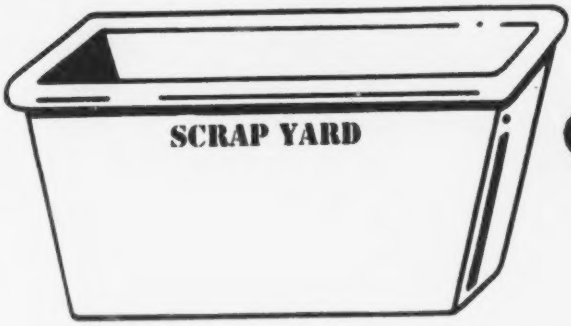
ACTIVITY FOUR

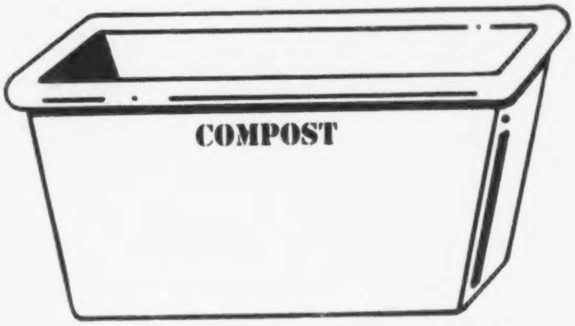
Recycling is terrific! If we recycle, we **can** protect our environment by reducing the amount of solid waste that goes into landfills. We **can** conserve our natural resources by using the same materials over again. We **can** cut down on air pollution from incineration. We **can** save energy and not have to depend so much on foreign oil.

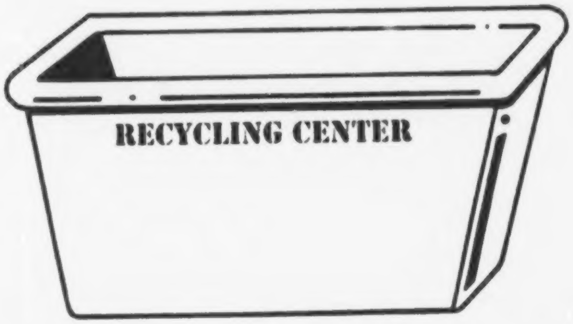
We **can** do it—and we will do it—if we all pitch in by separating our solid waste materials for curbside collection, or by bringing them to a recycling center. Get in practice by unscrambling the names of the solid waste items below. Which items can be separated for curbside collection? Which can be taken to a scrap yard or a recycling center? Which can be placed in a community compost site? Once you decide, start the recycling process and place each waste item where it belongs.

nasc
vaseel
atsiclp totlesb
rnhcasbe
tombolieaus
ompcuert appre
oodf cparss
wapesprens
gorferrietra
esobx
slags arsj
obok eleptonhe









Remember! The magnetic quality of steel makes it easy to separate from other materials. Look over your list of solid waste items. Use your personal "magnetism" to separate those items made of steel. List them here. ______________________________

____

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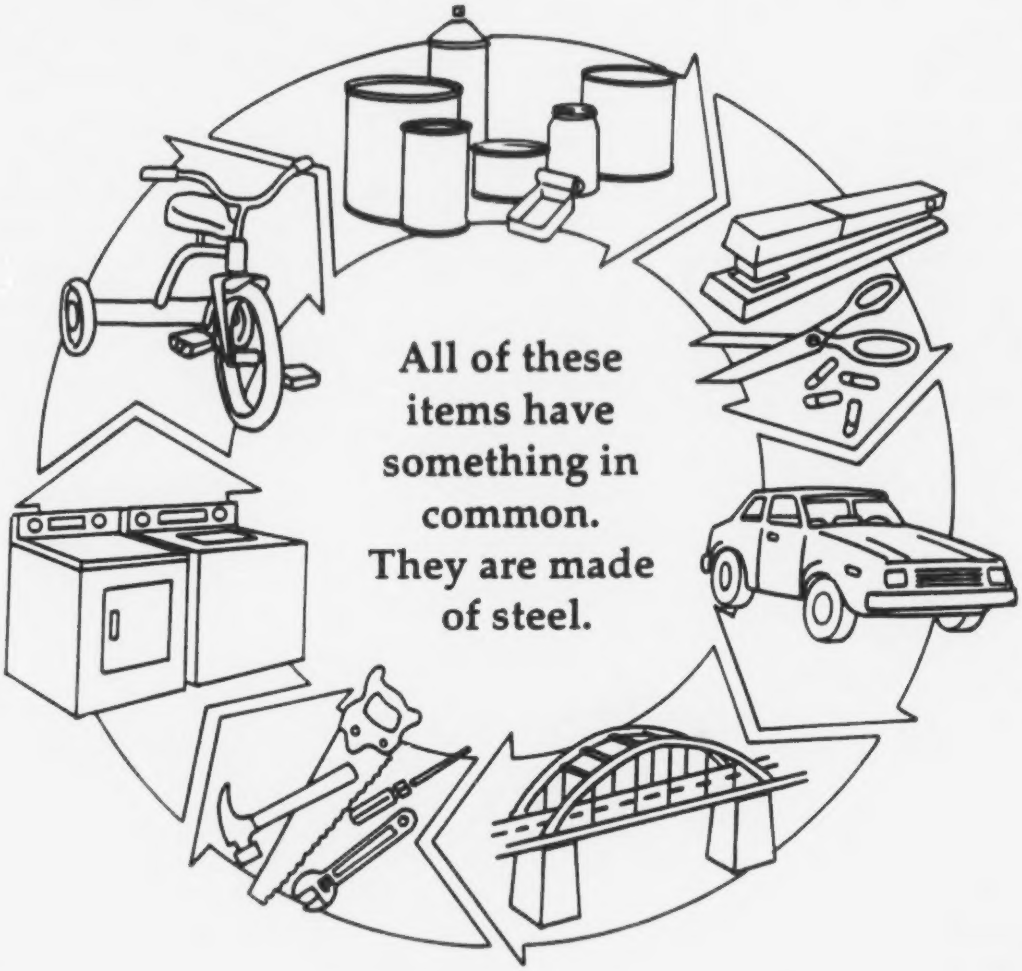
Steel the recycled material

STEEL RECYCLING LIFE CYCLE



All of these items have something in common. They are made of steel.

RECYCLE. AGAIN.

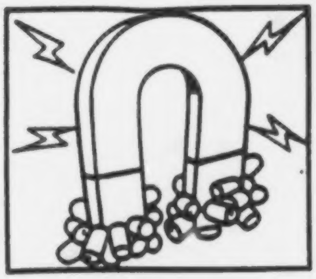
All steel products have something else in common. They all contain recycled steel.

THE CYCLE

To make new steel, you need old steel. When a steel can is recycled, it may become a car, a refrigerator, or a beam for construction. And when cars, refrigerators and beams are recycled, they become new steel products. Steel products, including steel cans, may be recycled over and over. So the steel can you're using today—whether it contains fruit or vegetables or other products—contains recycled steel, and may be recycled again.

Master sheet: Please copy on recycled paper.

STEEL CAN RECYCLING



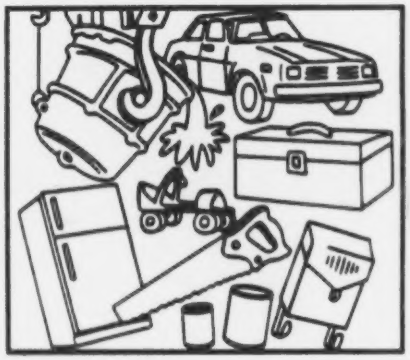
Steel can recycling is helped along by an important quality that only steel products have: they are magnetic. Steel cans may be removed from the solid waste stream or separated from other recyclables magnetically.

Empty steel cans may be collected for recycling through any recycling collection program. For curbside collection, steel cans need to be emptied and rinsed. They should be rinsed in leftover dishwater or in empty space in the dishwasher so that extra water isn't used for rinsing.

Steel cans are also collected through voluntary drop-off programs and multi-material recycling centers, where citizens who don't have curbside collection service may take their recyclable materials.

Finally, steel cans are recycled "automatically" at resource recovery plants (plants that convert solid waste into energy), where the cans are removed from the solid waste stream (the trash from your house) magnetically for recycling.

HOW STEEL MILLS USE STEEL CANS



After collection, steel cans and other steel products are sent to steel mills to be made into new steel. There are two types of furnaces used to make steel, depending on the product into which the steel will be made. One type is the basic oxygen furnace, which consumes about 25 percent "scrap." (Scrap is the steel industry's term for the old steel that will be recycled into new steel.) The other, the electric arc furnace, consumes about 100 percent scrap to make new steel. In either case, some of this scrap is steel leftover from steelmaking and product manufacturing, and the rest is steel products that have been "used up," such as cans, appliances, or cars.

Recycling helps preserve our environment. You can help your community by participating in recycling collection programs and by teaching others to recycle.

Steel Recycling Institute • 680 Andersen Dr.• Pittsburgh, PA 15220-2700 • 412/922-2772

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DEAR EDUCATOR:

You know that the best learning takes place when timely issues are linked with grade-level skills in your classroom. STEEL—AMERICA'S MOST RECYCLED MATERIAL is an educational program that takes an updated look at the national concern for the preservation and conservation of our environment. Since the program's message is particularly appropriate as our nation continues to celebrate the anniversary of Earth Day, we know you will want to include it in your upcoming teaching plans.

Developed by Lifetime Learning Systems in cooperation with the American Iron and Steel Institute, STEEL—AMERICA'S MOST RECYCLED MATERIAL is a complete interdisciplinary educational program. The program is designed to raise student awareness of the urgent need to recycle all renewable materials and of the benefits of using and conserving steel—one of the most environmentally friendly materials.

As they use the program's hands-on activities, your students will meet ROSCOE, the steel "spokescan," who encourages them to recycle and reuse! With ROSCOE as their guide, your students will learn the *whys* and *hows* of recycling and the role they can play in their community's recycling efforts.

Since the program's message is one that should spread beyond your classroom, we encourage you to share it with other teachers in your school and community. Although copyrighted, STEEL—AMERICA'S MOST RECYCLED MATERIAL may be reproduced in whole or in part for distribution to your colleagues.

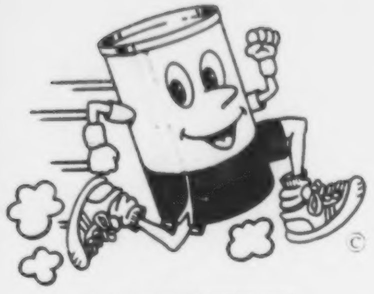
Please take a moment to fill out and return the enclosed response card. To keep our mailing lists updated, names of educators who do not respond to each program must be deleted. By returning the card, you will ensure that you will continue receiving FREE educational materials. As always, we welcome and appreciate your professional comments and suggestions.

Best wishes as you encourage your students to make every day Earth Day and to recycle steel.

Sincerely,

Dr. Dominic Kinsley
Editor in Chief

Lifetime Learning Systems, Inc.
. . . an Experience in Dynamic Education
79 Sanford St., Fairfield, CT 06430, (203) 259-5257



INTRODUCTION

Since Americans generate more than 400 000 tons of trash each day—150 million tons a year—there is a growing concern over how we will ever get rid of it all. STEEL—AMERICA'S MOST RECYCLED MATERIAL will help students understand the urgent need to recycle all renewable products and resources with particular focus on steel—our most recycled material. In fact, the use and recycling of products made of steel helps the U.S. save energy, conserve precious domestic natural resources and reduce the amount of solid waste generated.

As they complete the program's hands-on materials, your students will 1) Complete a crossword puzzle about steel facts. 2) Answer a questionnaire to determine their knowledge about steel cans. 3) Use graph information to solve math problems. 4) Unscramble words to identify garbage items and sort them for recycling. 5) Create storyboards to carry recycling messages. Most importantly, with ROSCOE as their guide, your students will learn that recycling is necessary for the good of our environment.

TARGET AUDIENCE

STEEL—AMERICA'S MOST RECYCLED MATERIAL is targeted for use by middle school students in grades 5-8. Although the program is created specifically for use in science classes, it is interdisciplinary in nature and encourages the use of math, language and thinking skills.

PROGRAM OBJECTIVES

STEEL—AMERICA'S MOST RECYCLED MATERIAL has been designed to fulfill the following general objectives:

- To communicate the economic, environmental and social benefits of recycling our renewable resources.
- To alert students and their families to the value of steel in the recycling process and to the steel industry's role as a leader in the crusade to reduce solid waste.
- To influence families to participate in solid waste separation and curbside collection programs.
- To utilize grade-level skills to solve puzzles and resolve mathematical problems.
- To provide teachers, students and parents with a real-world learning experience.

PROGRAM COMPONENTS

1. This teacher's guide which coordinates all components and includes
    - a statement of general objectives
    - suggested techniques for introducing the program and presenting materials
    - follow-up activities to reinforce and expand the goals of each activity master
    - extended activities to broaden the scope of the program
2. Five reproducible activity masters designed to provide individual worksheets for each student
3. A full-color wall poster to display in your classroom as an integral part of the program
4. An educator's response card. **Please complete and return to keep your name on our mailing list.**

USING THE PROGRAM

Wall Poster

Display the poster on a bulletin board or in another prominent place in your classroom. Introduce ROSCOE as the steel spokescan. Identify his name as an acronym—a word formed from the first letter or letters in a group of words. Explain that "scuba" is an acronym for "self-contained underwater breathing apparatus." Invite students to offer their opinions on a group of words whose initial consonants could make up the acronym ROSCOE. Accept all plausible answers before informing students that ROSCOE is an acronym for "**R**ecycle **O**ur **S**teel—**C**onserve **O**ur **E**nvironment." Then, give students an opportunity to study the poster and to offer their interpretations of its message. Conclude that the poster is a cartoon version of the steel recycling process. In reality, that process is sophisticated and state of the art. To illustrate this idea, challenge students to create a bulletin board depicting a realistic version of the poster idea. Students can, for example, clip pictures of steel cans, automobiles and refrigerators from newspapers and magazines. These items can be pinned to the bulletin board along with student drawings (or photographs) of modern recycling centers. Arrange the clippings and drawings as in the poster. One of your more artistic students might even draw a picture of ROSCOE to add to the display.

Activity One

DON'T THROW AWAY A GOOD THING!

This introductory activity acquaints students with the dual themes of th program: 1) the need to recycle to avoid depletion of our natural resources, and 2) the value of steel as America's most recycled materia Begin by asking students to guess the weight of the garbage each of them creates every day. Then tell them that that weight is approximately 4 pounds! To illustrate the point, work with the students to create a chalkboard list of the kinds of solid waste that end up in their garbage during a typical day. Keep the list on the chalkboard and distribute copies of the activity sheet. Read the introduction as a class and review ROSCOE's equation—more people = more garbage = less land. Refer to the chalkboard list and inform students that although all solid waste is potentially recyclable, not all waste is being recycled. For an item to be recycled, it must be sorted, collected, processed and used to produce other products. That's where steel is a star! Share the following information with your students:

- The amount of steel recycled annually equals roughly one third of the amount of all municipal solid waste landfilled in the U.S. each year.
- Steel recycling dramatically extends the useful life of landfills across the nation. In the last decade, steel recycling has extended the life of the nation's landfills by more than three years.

Help students to identify those items that are sorted for collection in your community. Then, instruct them to complete the activity sheet independently.

ANSWERS:

Across: 2 processing 5 limestone 7 waste 10 scarce 11 magnetic 14 environment 15 landfill 16 recycle. Down: 1 pollution 3 steel 4 generations 6 garbage 8 renewable 9 natural 12 conserve 13 scrap.

FOLLOW-UP ACTIVITIES

1. Encourage students to collect newspaper and magazine articles th deal with municipal waste disposal problems and solutions. Discus

the articles in class and display them on a bulletin board montage titled "Garbage—Everybody's Business!"

Investigate where your community's garbage is taken once it is collected. If possible, plan a class trip to a local landfill site. Before the trip, explain that in a landfill solid waste is covered with dirt and is not exposed to the oxygen or ultra violet light that would cause it to degrade or decay. Encourage students to question the officials at the site. (Example: What chemicals, if any, are used to treat the trash?)

As a homework assignment, have students take an inventory of steel products or packaging found in their homes. Encourage them to test for steel content by using a magnet. After compiling their lists, students can report their findings to the class. Compare lists and discuss the products students were surprised to learn were made of steel. Students can use the results of their inventories to write short paragraphs titled, "We Depend Upon Dependable Steel."

Have students research and discuss how long various items take to disintegrate (e.g., disposable diapers, plastic cups) if they are exposed to air, sunlight and the elements. (Steel will eventually decompose into iron oxide but this harmless decomposition is no substitute for recycling.)

Activity Two

YOU CAN DO IT WITH STEEL

This student survey activity focuses on your students' knowledge and misconceptions about steel cans. Introduce the activity by asking students to name the kinds of food products that are packaged in steel [illegible] Ask: What are some reasons why people buy foods that are [illegible]d in cans? Did you realize that these foods are packaged in containers made of steel? What do you know about this material? Present the idea that the comic strip character, Superman, is known as "the man of steel." What does this description tell us about this metal? Distribute copies of the activity sheet for students to complete in class. Instruct them to reword each statement with which they disagree on the back of the activity sheets. Explain that using both sides of a sheet of paper is a kind of recycling called reuse.

ANSWERS

1 Agree
2 Disagree—However, microwaveable steel cans are being developed and will be in use in the near future.
3 Agree
4 Disagree—Recycled steel cans are used to make any steel products including cars and appliances, as well as new steel cans.
5 Disagree—In most cases, the vitamin, mineral and fiber levels of steel-canned foods are as good as fresh, according to the U.S.D.A. and N.F.P.A.
6 Agree
7 Agree
8 Disagree—A steel can will eventually degrade into iron oxide if exposed to the natural elements.
9 Disagree—Tin is used as a coating for steel food and beverage cans because its unique properties make it the perfect coating for packaging. In addition, this coating makes the forming of cans easier and withstands the filling process and sterilization process to provide a safe package to protect food contents.
10 Agree
11 Agree
1[illegible] Disagree—**All** of the steel cans used by Americans each day are [illegible]00% recyclable.
13 Disagree—Steel beverage cans are often called "bimetal" cans because the body is made of steel and the top is made of aluminum.
14 Disagree—Removing labels and ends is not required to recycle steel cans. Both are readily consumed in the steelmaking furnace and, in some cases, provide an added benefit to the steelmaker.
15 Agree—All steel products contain at least 25% recycled scrap; this exceeds 95% in electric steelmaking furnaces.

FOLLOW-UP ACTIVITIES

1 Appoint a group of students to tally the survey responses to determine which statements were most often answered correctly, which were most often answered incorrectly. Then, have students take their surveys home for other family members to complete. (Students should cover their answers before presenting the survey to others.) Set aside a time for a report on the results of this take-home activity. How were their relatives' answers the same? How did they differ?
2 Have students use the 15 activity sheet statements (and any other steel can information) to create their own "cans of trivia." Each fact can be written on a construction paper cut-out of a steel can. The "cans" can be stacked (as in a supermarket display) and pinned to a bulletin board. You can also use the paper cans as game cards (questions on one side, answers on the other) to play a "steel pursuit" game.
3 As a research project, students can trace the history of the can from 1795 when the government of Napoleon offered 12,000 francs for a method of preserving food for its army and navy, to the present time. Results of the research can be used to create a cooperative timeline.

Activity Three

STEEL: THE COST CONTAINER

This math activity is designed to give students a clear, hands-on understanding of the economic and statistical aspects of recycling steel. Students will use their math, reading comprehension, visual perception and problem-solving skills to help ROSCOE solve problems based on information about recycling steel. (Note: Questions 1 and 2 are based on a graph showing comparative recycling rates of different materials. Questions 3-7 are word problems. Questions 6 and 7 are based on illustrations showing the amount of natural resources conserved by recycling steel.)

Introduce the activity with a general discussion of the value of statistics. Ask: How are statistics usually illustrated to present information in an easy-to-read format? Pass out copies of the activity sheet for students to complete in class.

ANSWERS:

1. D 2. B 3. 12 4. 330 tons 5. $11 billion 6. 62,500 lbs., 25,000 lbs., 1,000 lbs., 7. 7,500 lbs., 3,000 lbs.

FOLLOW-UP ACTIVITIES

1 Use the information provided in the graph, or in any of the word problems, to devise additional problems for the class to solve. Continue by having students create original problems for classmates to solve.
2 Have each student plot the following information on a bar or line graph. According to the Environmental Protection Agency (EPA) and the Institute of Scrap Recycling Industries (ISRI), the benefits of using recycled iron and steel instead of virgin iron ore, along with

new technologies in the steelmaking process, result in:

- 74% savings in energy
- 90% savings in virgin materials use
- 86% reduction in air pollution
- 40% savings in water use
- 76% reduction in water pollution
- 97% reduction in mining wastes

3. Explain that each year, steel recycling saves enough energy to meet the electrical power needs of the City of Los Angeles, CA, for more than eight years! Explain further that for every pound of steel recycled, 5,450 BTU of energy are conserved—enough to light a 60 watt bulb for over 26 hours! If every student in your class recycled 2 pounds of steel per week*, how many BTUs of energy would be conserved? How many hours would that energy allow a 60 watt bulb to burn?

* With more recycling of steel, the average American family should recycle 2 pounds of steel per week in the near future!

Activity Four

GET ON THE RECYCLE ROLL

Before distributing copies of this activity sheet, ask students to list reasons why each of them should be concerned about our environment. Spotlight recycling as a way in which individuals can become actively involved in the solution of one major environmental problem—solid waste. Determine why waste must be separated for recycling. Ask: Why is steel especially easy to separate from other materials?

ANSWERS:

Curbside Pickup—cans, newspapers, glass jars, plastic bottles; Scrap Yard—automobiles, refrigerator; Compost—branches, food scraps, leaves; Recycling Center—boxes, computer paper, telephone book. (Categories may vary from one community to another.)

FOLLOW-UP ACTIVITIES

1. Students can suggest additional items for each recycling category. This may be done as an extension of the game format, with the names of suggested items written in scrambled form for students to unscramble before placing an item in a category.
2. As a research assignment, students can investigate recycling plans or current recycling efforts underway in their own communities. Once findings are reported to the class, discuss whether current plans or efforts are sufficient to serve the community's needs. Have students offer suggestions for improving local recycling plans and share them with community officials.

Note: For more information about steel and steel recycling, write to:

American Iron and Steel Institute
1133 15th St., N.W.
Washington, D.C. 20005-2701

Steel Can Recycling Institute
Foster Plaza 10
680 Andersen Dr.
Pittsburgh, PA 15220

3. If possible, plan a field trip to a steel recycling plant so that students can view the recycling process first-hand. Before the visit, draw on the information learned from this program to create a series of meaningful questions to ask of the plant's personnel. If there is a detinning operation nearby, either plan to visit it or call for information about the additional benefits of this process.

Activity Five

A STEEL PURPOSE

Distribute copies of the activity sheet and call attention to the cartoon storyboard at the top of the page. Read the activity-sheet instructions with your students and ask them to complete this storyboard as directed. Give each student an opportunity to share his or her completed work. Challenge the students to complete the activity with facts and ideas they learned while working on this unit.

FOLLOW-UP ACTIVITIES

1. After students share their original storyboards, invite them to create enlarged versions of them on the back of the activity sheet. In this case, the sheet can be divided into equal quarters. Display the finished enlargements on a school corridor bulletin board to spark a recycling effort in your school community. Perhaps your class could spearhead the program by placing a steel can recycling bin in a convenient spot in your school.
2. Suggest that students use the storyboards as ideas for spot announcements to be given over your school's public address system. Additionally, storyboard ideas can be used to create public service campaigns which would include posters, news ads, videotaped ads, radio spots, etc. Present these announcements to local newspapers and public access TV and/or radio stations.
3. To drive home the importance of recycling, work with students to create a rap song presenting the importance of the effort. Start with the following: *ROSCOE's no fool, he's one smart can. He knows that recycling starts with a plan. He sorts through his garbage. He picks this from that. He...*
   Students can take turns adding individual lines to the rap or work cooperatively to finish it.

EXTENDED ACTIVITIES

1. Invite students to bring magnets to class to experience the unique magnetic quality of steel. Discuss how they and their families have used magnets in the home (e.g., to place notices on refrigerator doors). Continue by having the students identify the many uses of steel in our environment. They may compile their information through observation, questioning and library research.
2. Have students suggest future uses for steel. Begin by reviewing the many advantages of steel products now in use. Students may wish to illustrate their creative ideas for display on a classroom bulletin board.
3. As a creative writing assignment, have each student select a steel can now sitting on a shelf in his or her kitchen and write an adventure story telling about the last twenty years in the "life" of that can. What was the can twenty years ago? ten years ago? How many times has it been recycled? What was its favorite thing to be? How did it end up as a container for food? As they write their stories, students might enjoy naming their cans and having them tell about how they met ROSCOE along the recycling route. Before they begin writing, inform students that today's steel can—stronger and lighter than ever before—contains an average of one-third less metal than the steel can produced in 1975. That's another way that steel is helping to conserve our natural resources.

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Lifetime Learning Systems

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Steel
the recycled material

ROSCOE Says...

Test Your Knowledge

First Try
ROSCOE' s Resource Recovery Quiz
True or False

T or F

1. _____ _____ Energy can be generated through the combustion of waste.

2. _____ _____ If an item cannot be reused or recycled, nothing can be done to prevent it from taking up valuable landfill space.

3. _____ _____ Steel melts at 1600° F.

4. _____ _____ Steel is America's number one recycled material.

5. _____ _____ A resource recovery facility is a place where workers sort through material which is dropped off in order to find items (such as clothes and furniture) which can be reused.

6. _____ _____ Steel can be **automatically** recycled from a resource recovery facility.

7. _____ _____ There are at least 150 resource recovery facilities in the United States.

8. _____ _____ Resource recovery facilities and waste-to-energy facilities are simply different names for the same type of plants.

* **After** attempting the quiz, read the following material to discover the correct answers.

Resource Recovery Facility

A resource recovery facility, also known as a waste-to-energy plant, is a facility at which municipal solid waste, household trash and other ordinary items are combusted as fuel to create energy. Resource recovery facilities help to reduce the amount of waste a community must landfill by burning the waste in highly efficient and carefully monitored equipment. Through this process, a mountain of waste can almost literally be made into a mole hill. In fact, experts estimate that up to 90 percent of the waste is eliminated leaving behind only ash or scrap material.

In addition to reducing the amount of solid waste that must be landfilled, a resource recovery facility also has the advantage of producing electricity which can supplement a community's electrical power needs. During the combustion of the trash, heat is emitted; steam is then created which is used in a steam-driven turbine to generate electricity.

(continued)

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Answers/Side B. 1. ROSCOE; 2. Electricity; 3. Community; 4. You; 5 Consumers; 6. Landfills; 7. Everyone; 8. Steel; 9. Temperature; 10. Estimate; 11. Energy; 12. Lead; 13. Cans; 14. America; 15. Needed; 16. Steel. ROSCOE's message: Recycle Steel Cans (and other recyclables).

Side B
(Complete the Prequiz on Side A FIRST)

Another benefit of a resource recovery facility is that steel, the most recycled material in America, can be very efficiently recovered for recycling. Because steel is magnetic, it may be separated from the solid waste stream **before** the waste is combusted. Or, because steel needs to reach a temperature of 2750 degrees in order to melt, it is not destroyed in the combustion process. Generally resource recovery facilities burn at a temperature of 1200 to 1800 degrees. This means, if not separated prior to the burning, steel left behind in the ash can be gathered **after** the combusting thereby being automatically recycled. Can you guess how the steel is removed at this point? If you said by a magnet, you are absolutely correct.

A resource recovery facility greatly reduces the amount of solid waste that must be landfilled and creates electricity which a community can sell or use itself. Resource recovery facilities contribute to steel recycling efforts by magnetically separating cans and other steel items for recycling.

Use the first letter of each answer below to decode ROSCOE's message

1) The Steel Recycling Institute's mascot whose name stands for: Recycle Our Steel; Conserve Our Environment: _ _ _ _ _ _

2) The form of energy produced at a resource recovery facility: _ _ _ _ _ _ _ _ _ _ _

3) A group of people who might benefit from a resource recovery facility: _ _ _ _ _ _ _ _ _

4) Who should recycle: _ _ _

5) People who buy steel products: _ _ _ _ _ _ _ _ _

6) Used in place of dumps today: _ _ _ _ _ _ _ _ _

7) Who benefits from recycling: _ _ _ _ _ _ _ _

8) The most recycled material in America: _ _ _ _ _

9) Melting steel requires a high: _ _ _ _ _ _ _ _ _ _ _

10) To make an educated guess or to: _ _ _ _ _ _ _ _

11) Steel recycling conserves this: _ _ _ _ _ _

12) When it comes to recycling, steel is in the: _ _ _ _

13) These everyday items we use are made from steel or aluminum: _ _ _ _

14) Steel is the most widely recycled material in: _ _ _ _ _ _ _

15) To make new steel, old steel is: _ _ _ _ _ _

16) Is attracted to magnets: _ _ _ _ _

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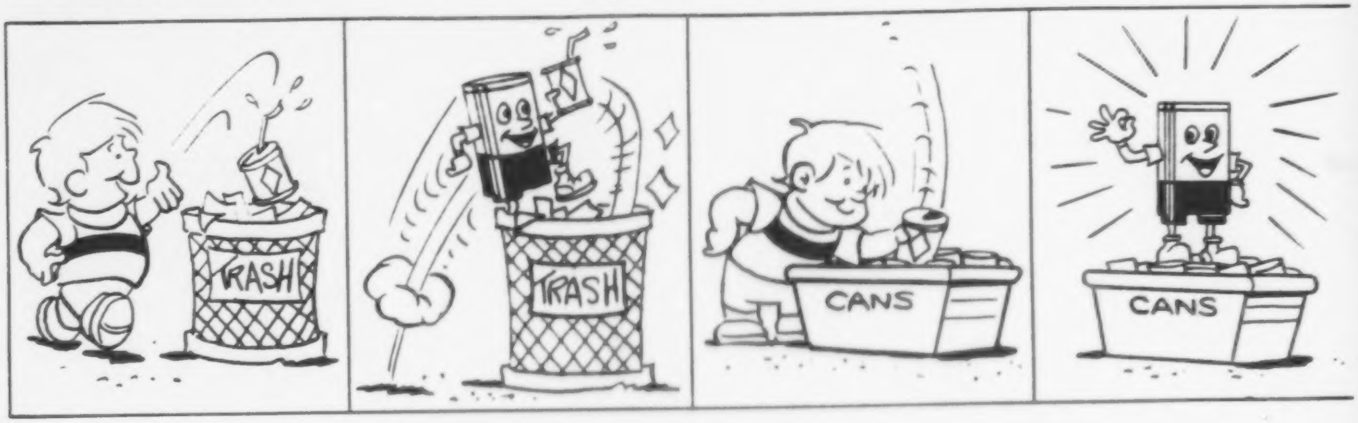
Answers/Side A 1.T 2.F 3.F 4.T 5.F 6.T 7.T 8.T

Recycling Institute • 680 A ersen Dr. • Pittsburgh, PA 15220-270 Printed on recyc d paper with soy-based ink. RQ-100 3/95

A STEEL PURPOSE

ACTIVITY FIVE

Here's your chance to show what you know about the importance of recycling, especially recycling steel. First, complete the storyboard below. Under each picture, write what you think each character is saying. End the storyboard with a clever, original slogan like "Recycle Steel: Can Do!"



Now use your knowledge of steel and recycling to create an original storyboard. Try to include **me** your story. I can help you deliver your recycling message.

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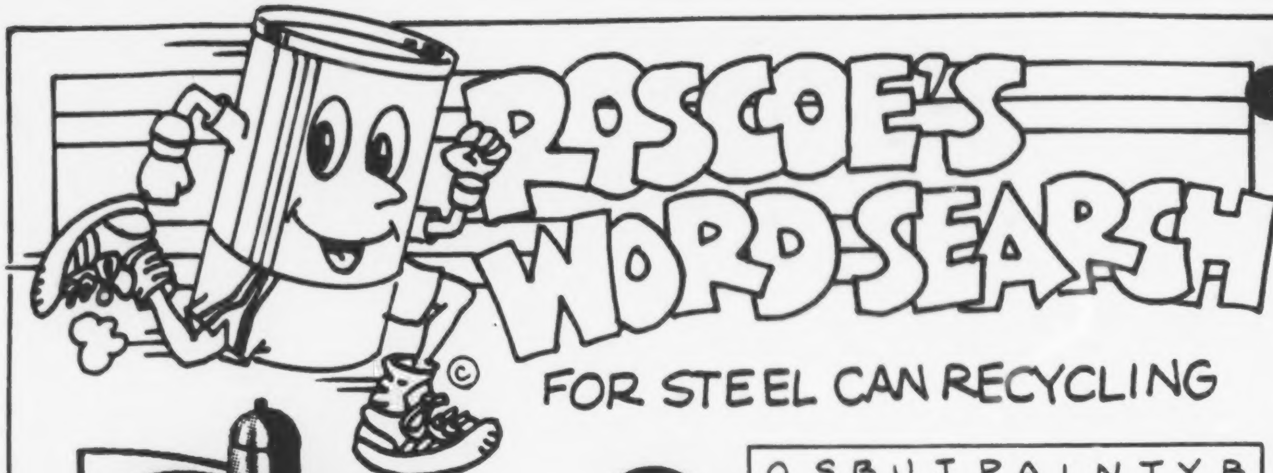
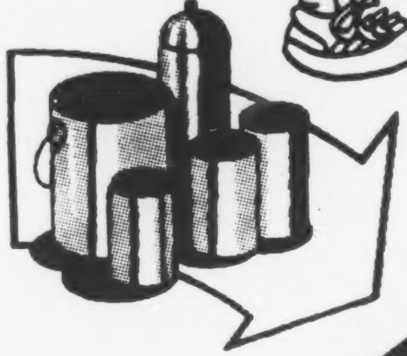


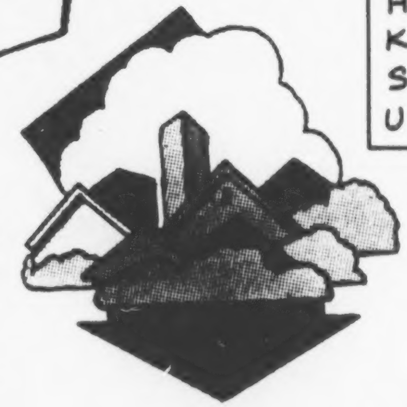
ROSCOE'S WORD-SEARCH

FOR STEEL CAN RECYCLING

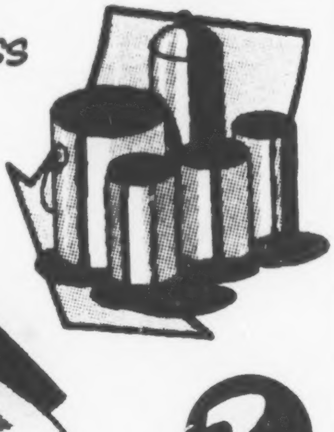


1.

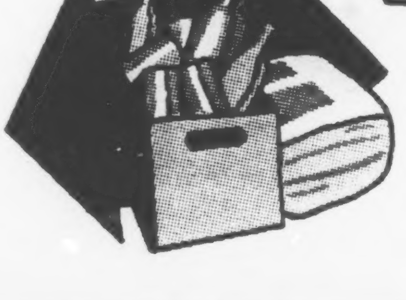
O	S	B	U	J	P	A	I	N	T	Y	B
B	T	W	H	N	O	E	G	R	I	A	E
R	E	S	T	A	U	R	A	N	T	B	V
I	E	C	Z	R	H	O	M	E	X	G	E
V	L	H	L	M	V	S	S	A	C	Q	R
H	C	O	N	T	F	O	O	D	B	V	A
K	F	O	S	H	A	L	C	G	P	I	G
S	A	L	T	A	O	U	R	M	H	T	E
U	G	X	H	O	T	E	L	Z	F	A	R



See if you can find the words that fit these sections of the steel can recycling cycle. Words are across or down only.



C	A	L	Y	L	E	G	L	A	S	S	H
A	L	U	M	I	N	U	M	K	B	X	E
N	U	G	E	D	O	C	N	I	D	G	M
S	M	A	T	S	T	E	E	L	T	J	P
C	A	S	P	L	A	S	T	I	C	A	T
U	B	I	S	T	L	O	L	I	M	R	Y
R	E	C	Y	C	L	A	B	L	E	S	X
A	N	K	R	Z	S	M	S	N	R	G	A
C	U	R	B	S	I	D	E	T	T	B	C
T	T	I	V	E	P	L	L	G	W	I	O
N	E	W	S	P	A	P	E	R	U	N	R



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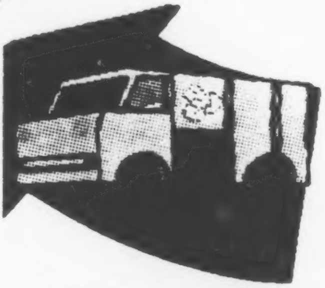
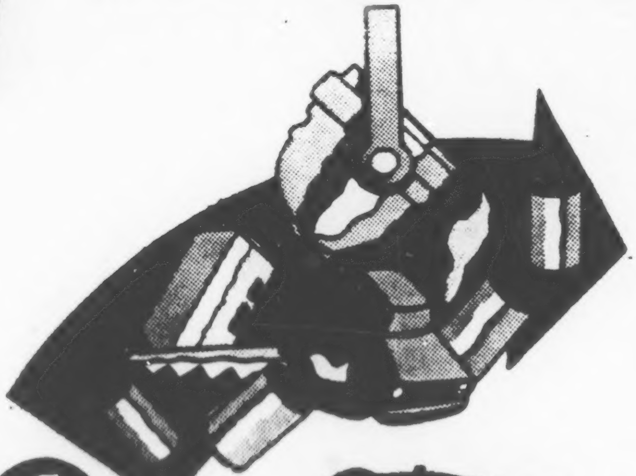


3.

M A G N E T I C A D J E C
S T E B A K P K C A N G U
E I X Y N L I I S H C Y R
P R K T R A N S P O R T B
A R E C Y C L A B L E X S
R E O Y U S S I M M L F I
A N C N P B A L E Y E Y D
T S O G T J Q A U S C F E
I N A C O L L E C T I O N
O A F V N A O G L E J N Z
N C M T R U C K W E N H I
V E I S R I Y Q U L L I R



4.

A N P O M I B Y W I G R Y
T S E S A W E V Y N I B I
B Y R A Y T Z A M T R A F
M O L T E N S T E E L B B
O G O I K C A I N K S K O
D Y N P O N T N I X R O Y
S T E E L P R O D U C T S
I A W O M E N S U Q E I N
M Y T P A H I T A U E G A
H I U L A L P U C A R A C
I L Q E L A N V A N O L K
P X U N M C A N S I C A L

...IF YOU NEED A CLUE, THESE ARE THE WORDS YOU SHOULD LOOK FOR IN EACH SECTION—

① PAINT, RESTAURANT, HOME, FOOD, HOTEL, STEEL, SCHOOL, AEROSOL, BEVERAGE.

② EMPTY, CANS, LIDS, STEEL, BIN, RECYCLABLE, CURBSIDE, PLASTIC, GLASS, ALUMINUM, NEWSPAPER.

③ CURBSIDE, COLLECTION, TRUCK, MAGNETIC, SEPARATION, STEEL, CAN, BALE, TRANSPORT, RECYCLABLE.

④ NEW, STEEL, PRODUCTS, CAR, SAW, CANS, MOLTEN STEEL, MEN, WOMEN, BOYS, GIRLS, PEOPLE.

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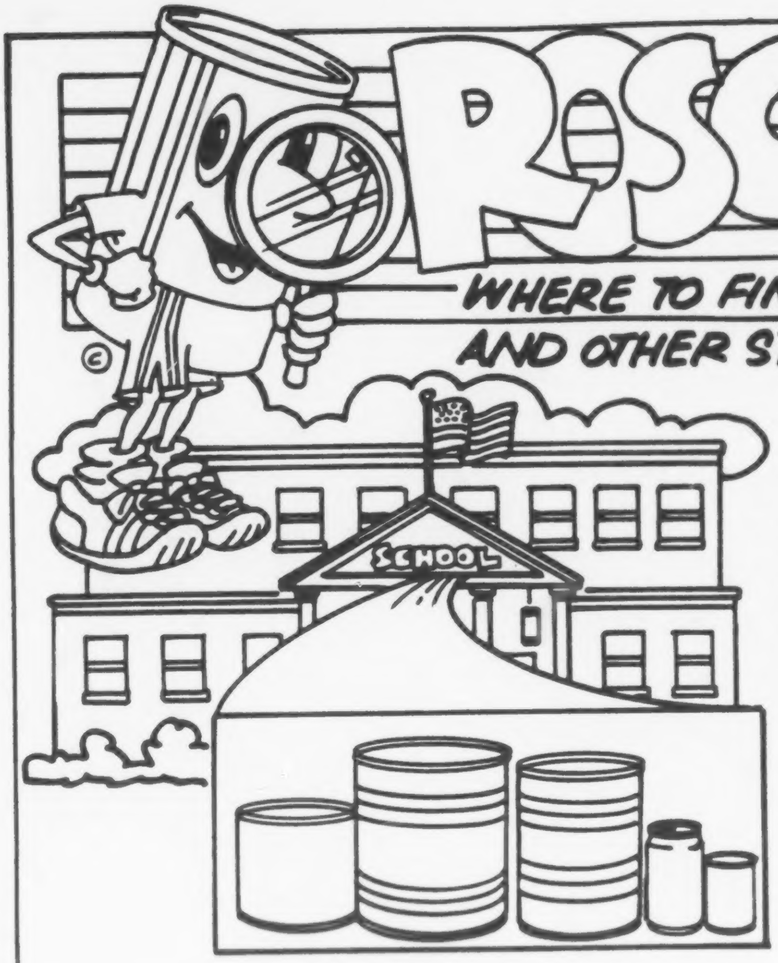
America's Steel Most Recycled Material

STEEL RECYCLING INSTITUTE
680 ANDERSEN DRIVE, PITTSBURGH, PA 15220

C1

Printed on recycled paper with soy-based ink.



ROSCOE'S

WHERE TO FIND STEEL CANS AND OTHER STEEL PRODUCTS

AT SCHOOL

IF YOUR SCHOOL HAS A CAFETERIA, YOU CAN FIND STEEL CANS THERE. THESE ARE THE VERY LARGE STEEL CANS AND YOUR SCHOOL MAY ALSO BE RECYCLING THEM.

WHAT OTHER THINGS IN YOUR SCHOOL ARE MADE OF STEEL?

FLAG POLE ____________________

FILE CABINETS ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

____________________ ____________________

IN YOUR KITCHEN

YOUR KITCHEN HAS LOTS OF STEEL PRODUCTS.

CAN YOU NAME SOME OF THEM?

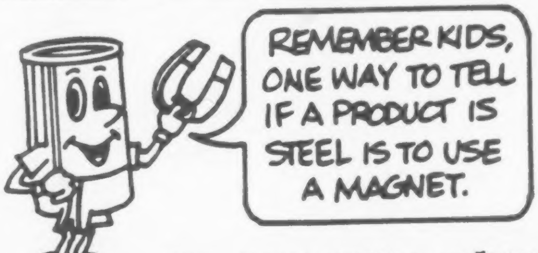
CANS ON SHELVES ____________________

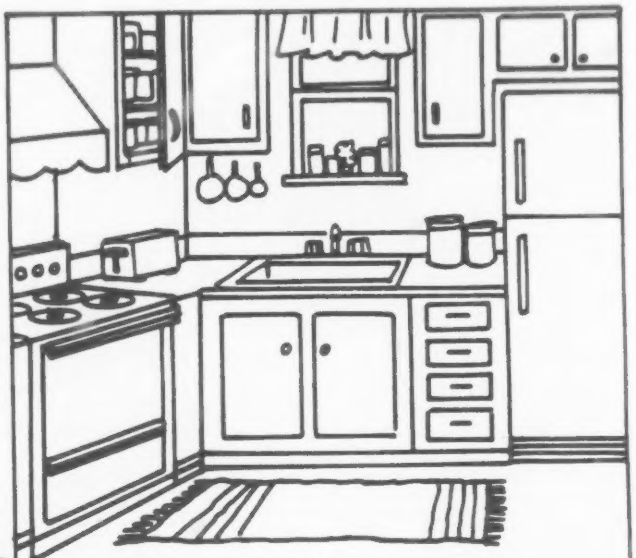
REFRIGERATOR ____________________

____________________ ____________________

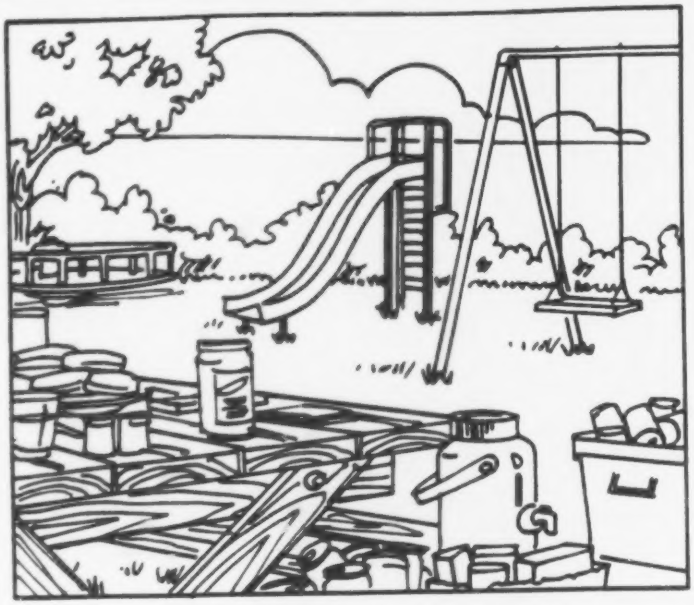
____________________ ____________________

____________________ ____________________


REMEMBER KIDS, ONE WAY TO TELL IF A PRODUCT IS STEEL IS TO USE A MAGNET.



HINT: DON'T FORGET TO "LOOK" IN DRAWERS AND CABINETS.



PICNIC IN THE PARK

PICNICS ARE WARM WEATHER FUN. REMEMBER TO TAKE YOUR STEEL CANS AND OTHER RECYCLABLES HOME FOR RECYCLING OR PUT THEM IN THE RECYCLING BIN AT THE PARK.

WHAT OTHER STEEL PRODUCTS MIGHT YOU FIND AT A PARK PICNIC?

SODA POP CANS

SLIDE

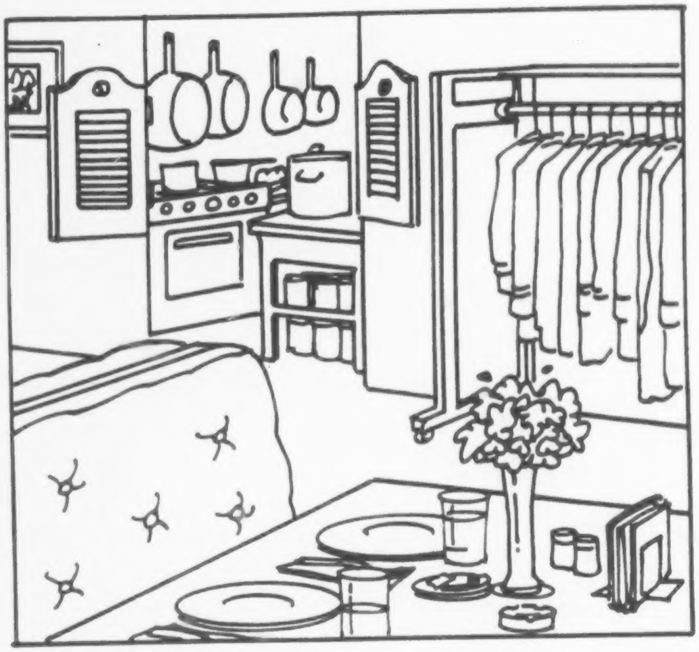
IN A RESTAURANT

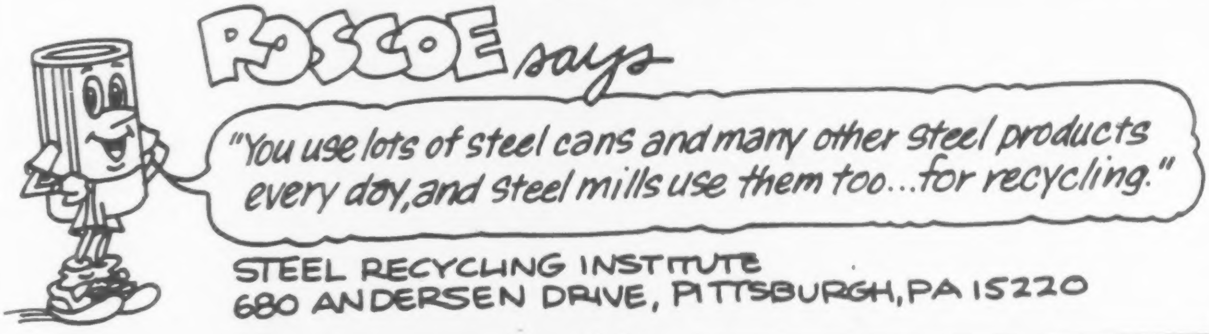
IN A RESTAURANT KITCHEN YOU'LL FIND THE SAME LARGE STEEL CANS THAT YOU FOUND IN YOUR SCHOOL CAFETERIA. THERE ARE MANY OTHER STEEL PRODUCTS AS WELL.

CAN YOU NAME A FEW FROM THE KITCHEN AND DINING AREA?

COOKING PAN

COAT RACK




ROSCOE says
"You use lots of steel cans and many other steel products every day, and steel mills use them too...for recycling."

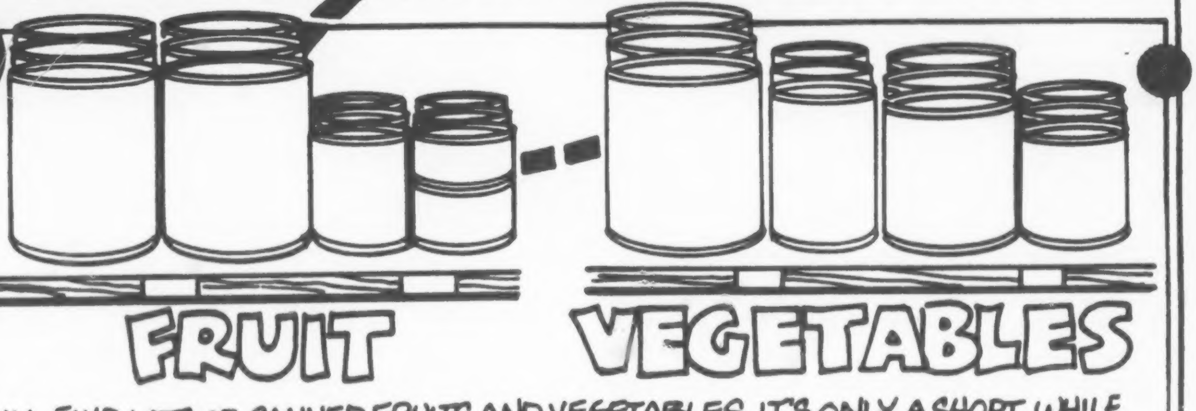
STEEL RECYCLING INSTITUTE
680 ANDERSEN DRIVE, PITTSBURGH, PA 15220

Printed on recycled paper with soy-based ink.

ROSCOE'S STEEL CAN RECYCLING GROCERY STORE TOUR

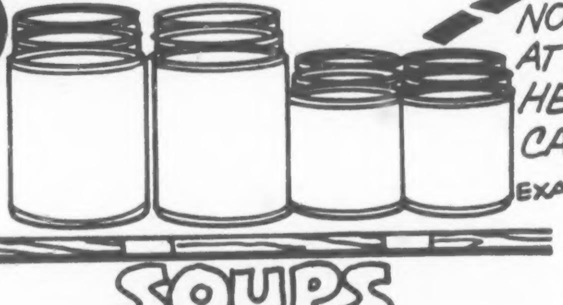
1. HI, WELCOME TO THE GROCERY STORE! LET'S GO SEE HOW MANY STEEL CANS WE CAN FIND.

2.



YOU'LL FIND LOTS OF CANNED FRUITS AND VEGETABLES. IT'S ONLY A SHORT WHILE BETWEEN THE TIME THEY ARE HARVESTED AND CANNED, SO YOU KNOW VITAMINS AND NUTRIENTS ARE STILL INSIDE TO HELP YOU GROW. COLOR THE CANS WITH PICTURES OF YOUR FAVORITE FRUITS AND VEGETABLES.

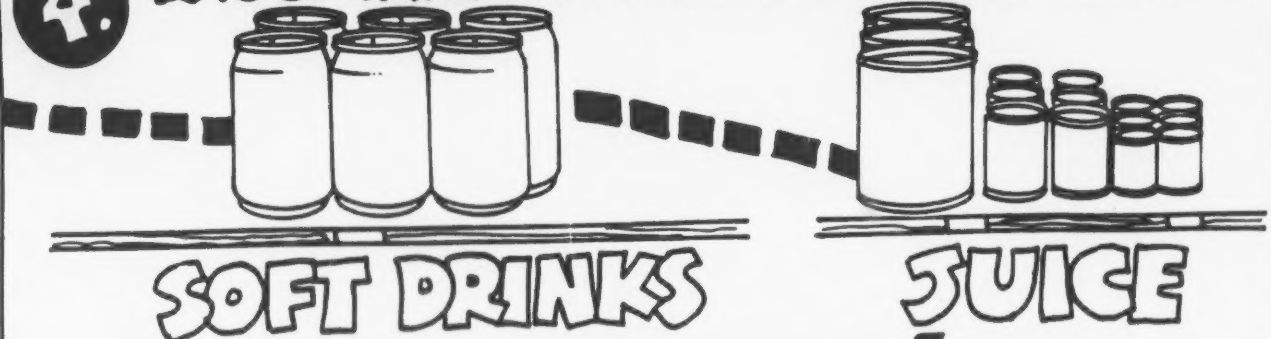
3.



NOW, WE'RE IN THE SOUP AISLE. LOOK AT ALL THE CHOICES YOU HAVE FOR A HEALTHY, HOT BOWL OF SOUP. CAN YOU NAME SOME KINDS OF SOUP?

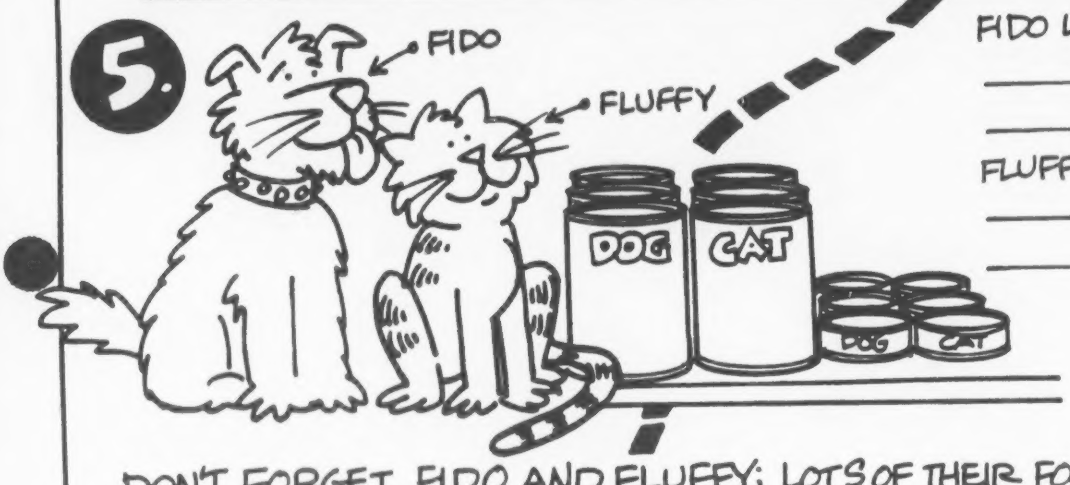
EXAMPLE: TOMATO

4. LOTS OF THINGS YOU DRINK COME IN STEEL CANS, TOO.


SOFT DRINKS
JUICE

WRITE THE NAMES OF YOUR FAVORITE SOFT DRINKS AND JUICES ON THE CANS.

5.


FIDO
FLUFFY
DOG
CAT
DOG
CAT

FIDO LIKES:

____

____

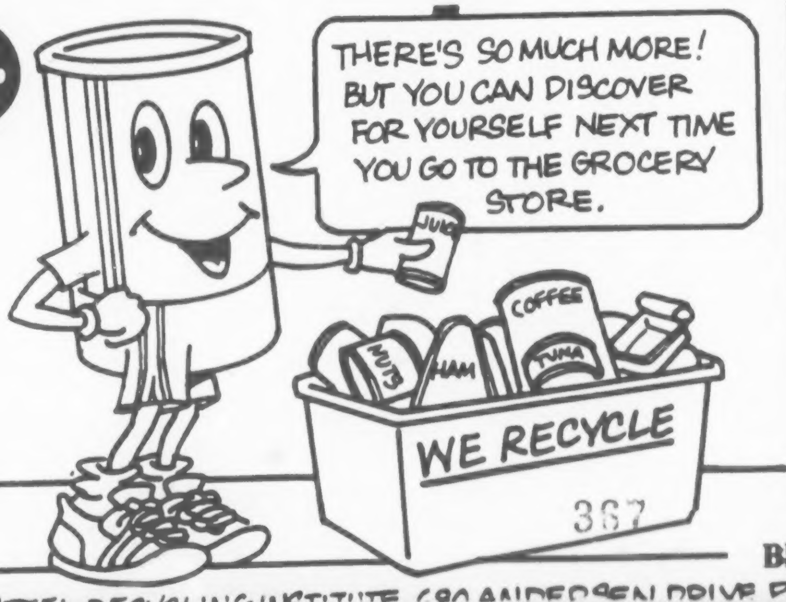
FLUFFY LIKES:

____

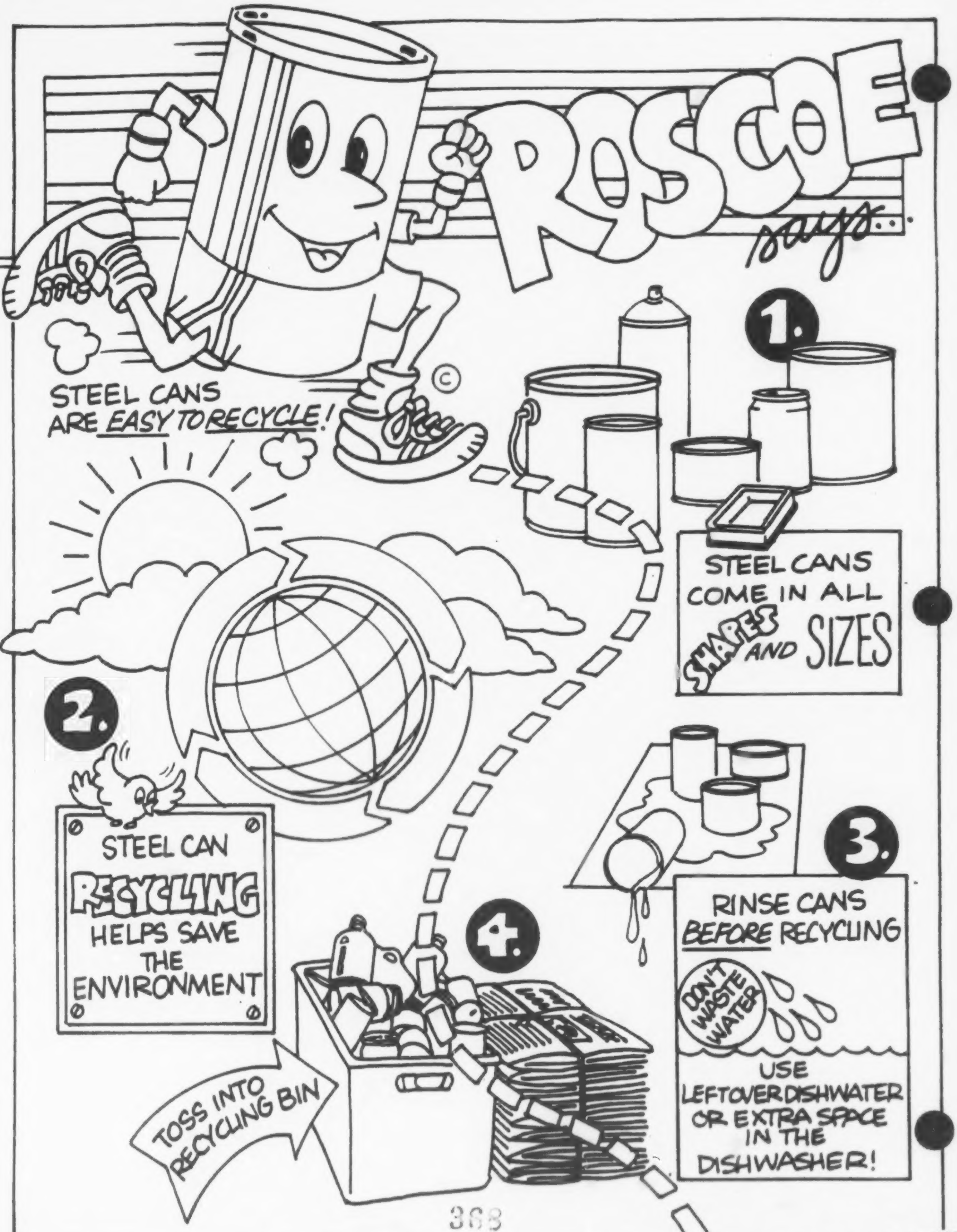
____

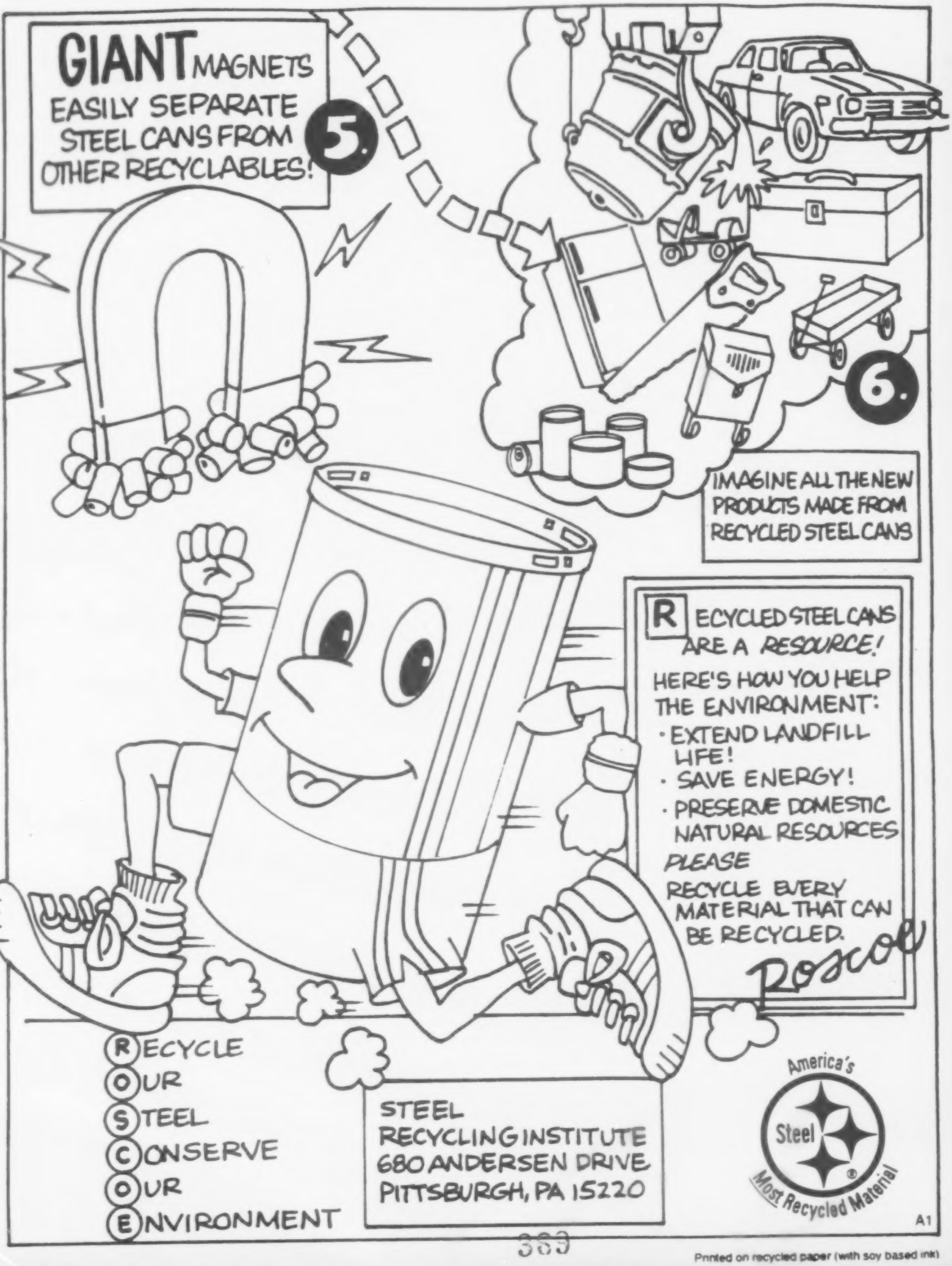
DON'T FORGET FIDO AND FLUFFY; LOTS OF THEIR FOOD COMES IN STEEL CANS, TOO. SEE ALL THE DIFFERENT KINDS OF FOODS FOR THEM!

6.


THERE'S SO MUCH MORE! BUT YOU CAN DISCOVER FOR YOURSELF NEXT TIME YOU GO TO THE GROCERY STORE.
JUICE
COFFEE
TUNA
HAM
WE RECYCLE

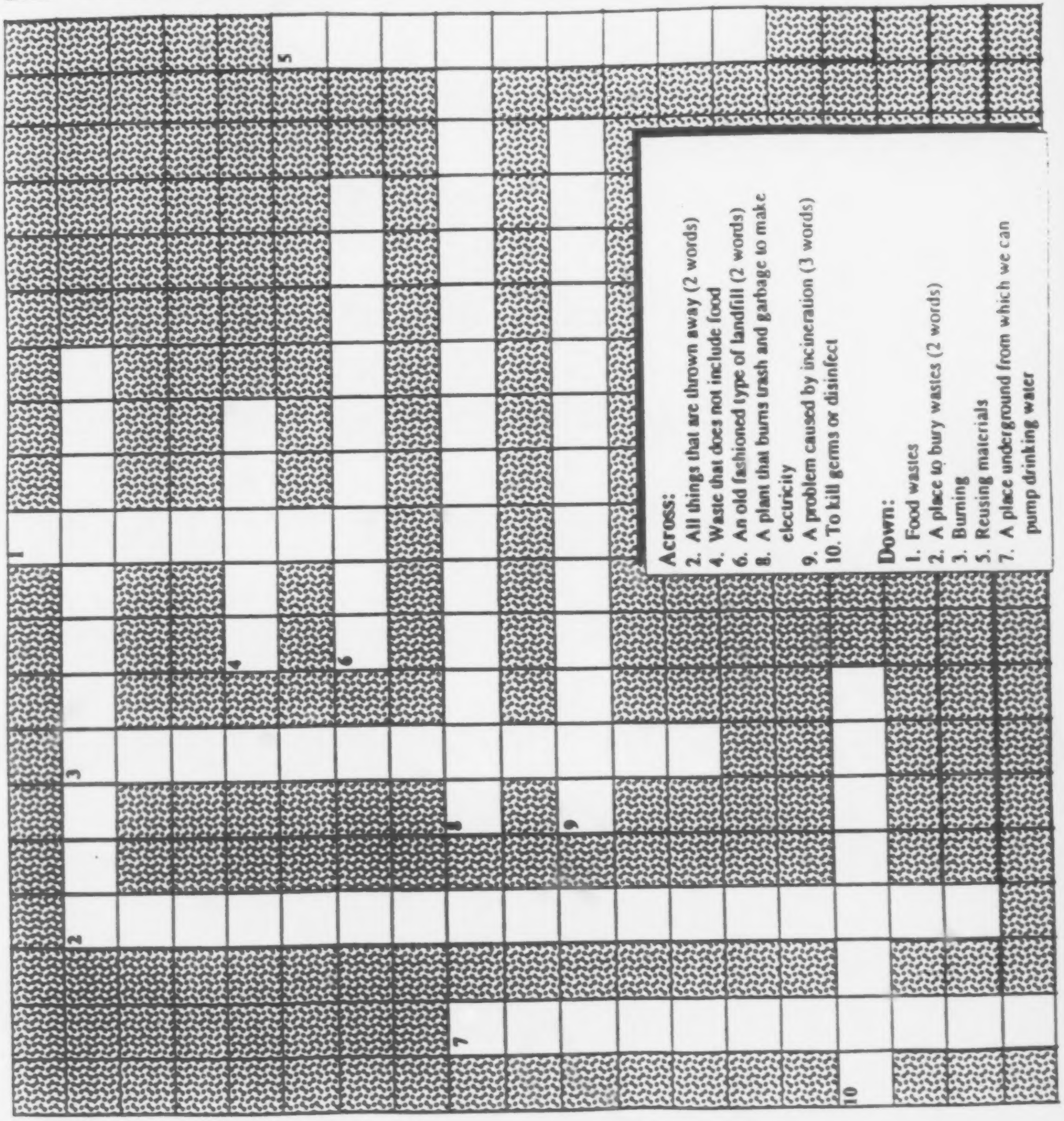
YOUR TOUR ENDS HERE, BUT IT'S ONLY THE BEGINNING FOR YOUR STEEL CANS. AFTER YOU USE THEM, WHERE DOES THEIR TOUR CONTINUE? *TO THE RECYCLING BIN!* AND SOON THEY WILL BEGIN A NEW TOUR AS A BRAND NEW STEEL PRODUCT. ***REMEMBER TO RECYCLE!***


ROSCOE says...
STEEL CANS ARE EASY TO RECYCLE!
©
1.
STEEL CANS COME IN ALL SHAPES AND SIZES
2.
STEEL CAN RECYCLING HELPS SAVE THE ENVIRONMENT
3.
RINSE CANS BEFORE RECYCLING
DON'T WASTE WATER
USE LEFTOVER DISHWATER OR EXTRA SPACE IN THE DISHWASHER!
4.
TOSS INTO RECYCLING BIN


GIANT MAGNETS EASILY SEPARATE STEEL CANS FROM OTHER RECYCLABLES!
5.
6.
IMAGINE ALL THE NEW PRODUCTS MADE FROM RECYCLED STEEL CANS
R ECYCLED STEEL CANS ARE A *RESOURCE!*
HERE'S HOW YOU HELP THE ENVIRONMENT:
· EXTEND LANDFILL LIFE!
· SAVE ENERGY!
· PRESERVE DOMESTIC NATURAL RESOURCES
PLEASE
RECYCLE EVERY MATERIAL THAT CAN BE RECYCLED.
Roscoe
Ⓡ ECYCLE
Ⓞ UR
Ⓢ TEEL
Ⓒ ONSERVE
Ⓞ UR
Ⓔ NVIRONMENT
STEEL RECYCLING INSTITUTE
680 ANDERSEN DRIVE
PITTSBURGH, PA 15220
America's Steel ® Most Recycled Material
A1

Printed on recycled paper (with soy based ink)

Where Does the Garbage Go?



Across:

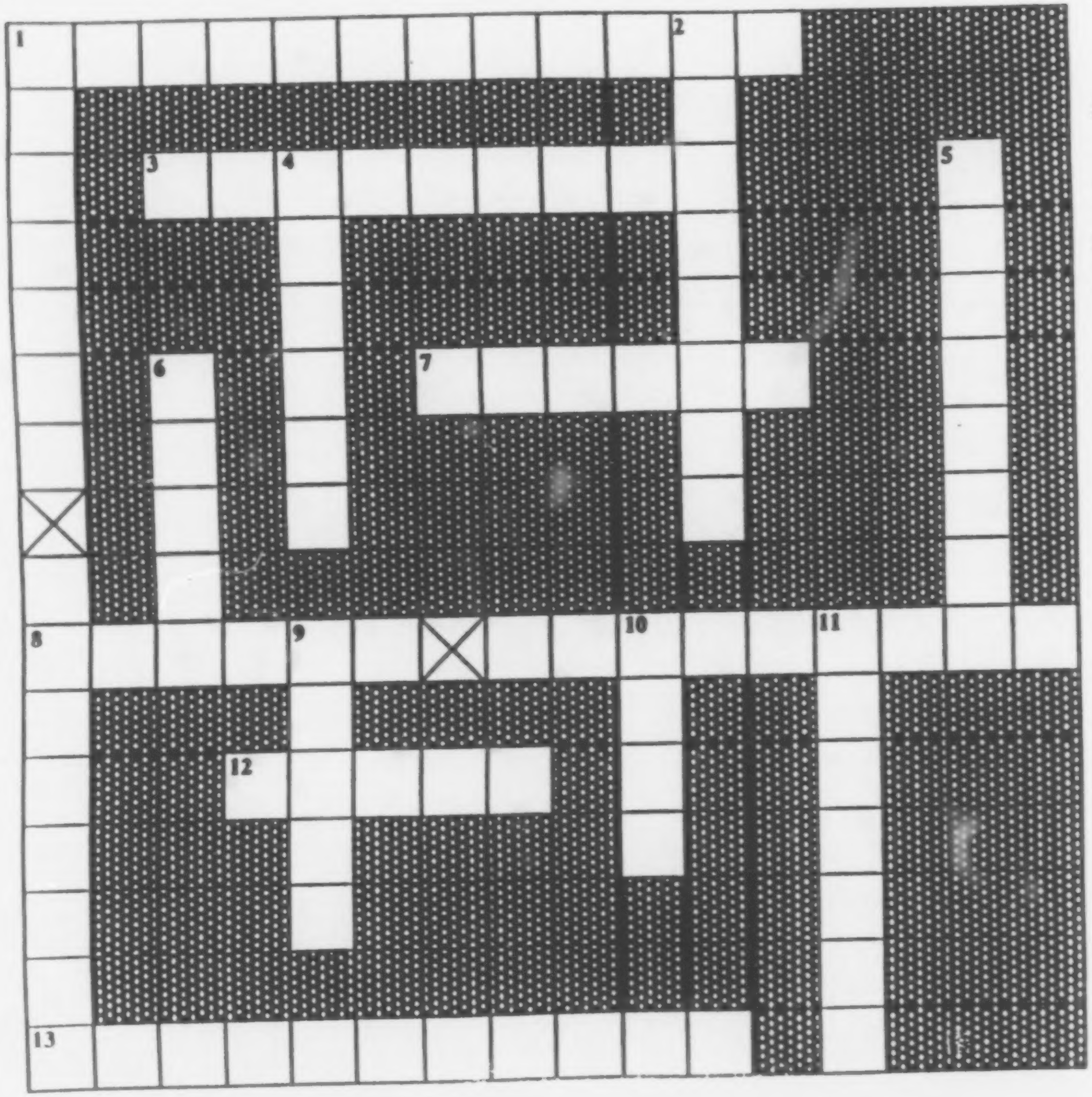
2. All things that are thrown away (2 words)
4. Waste that does not include food
6. An old fashioned type of landfill (2 words)
8. A plant that burns trash and garbage to make electricity
9. A problem caused by incineration (3 words)
10. To kill germs or disinfect

Down:

1. Food wastes
2. A place to bury wastes (2 words)
3. Burning
5. Reusing materials
7. A place underground from which we can pump drinking water

Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

RECYCLING REASONS CROSSWORD



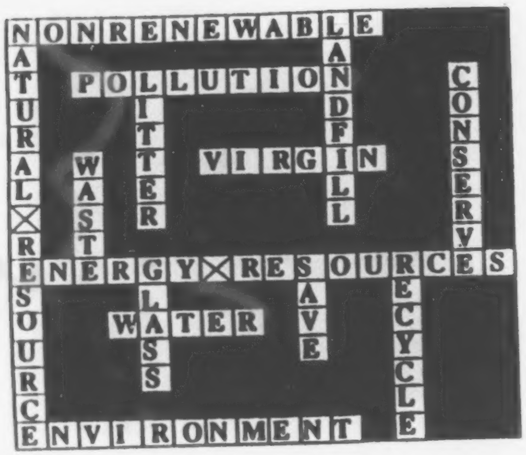
ACROSS CLUES

1. Something that we can't make more of (when it's gone, it's gone).
3. A problem sometimes caused by landfills.
7. A new or natural material
8. Fossil Fuels (2 words)
12. A substance that can be polluted by manufacturing
13. Our natural surroundings

DOWN CLUES

1. Metal is an example (2 words)
2. A place where wastes are buried
4. Wastes in the environment
5. Protect and use wisely
6. Something that is discarded when it is no longer useful
9. A material that can be recycled
10. Another word for conserve
11. To use again

Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

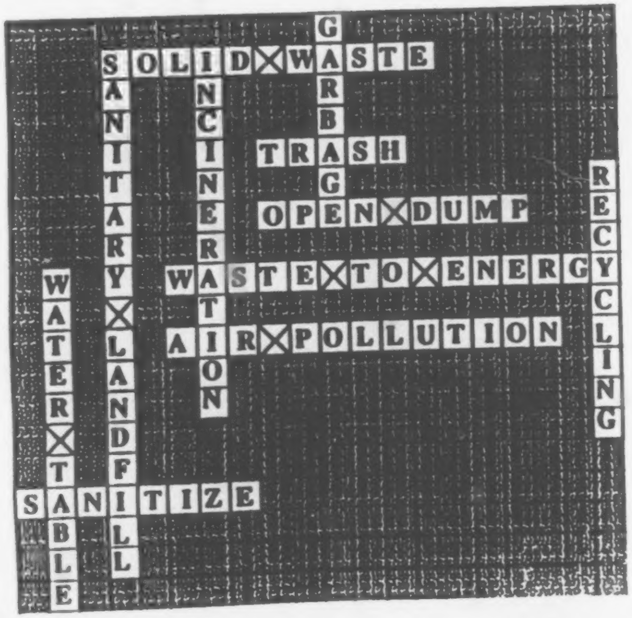


WORD LIST FOR RECYCLE REASONS CROSSWORD PUZZLE

Conserve
Energy Resources
Environment
Glass
Landfill

Litter
Natural Resources
Nonrenewable
Pollution
Recycle

Save
Virgin
Water
Waste



WHERE DOES THE GARBAGE GO? CROSSWORD PUZZLE WORD LIST

Air Pollution
Garbage
Incineration
Open Dump

Recycling
Sanitize
Sanitary Landfill
Solid Waste

Trash
Waste to Energy
Water Table

Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

Use the code key below to name some items that can be made from recycled paper, glass and aluminum.

CODE KEY: A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
Z Y X W V U T S R Q P O N M L K J I H G F E D C B A

1. X V I V Z O   Y L C

2. H L W Z   X Z M

3. H K Z T S V G G R   H Z F X V   Q Z I

4. Z O F N R M F N   U L R O

ACTIVITY #2

Decide whether the following items can be made from either recycled paper, aluminum or glass.

1. Pickle jar ____________________
2. Cookie box ____________________
3. Soft drink can ____________________
4. Egg carton ____________________
5. Small soda bottle ____________________

Puzzle courtesy of Millcreek Area School District, Erie County

Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

FIND THE RECYCLING WORDS

```
C G I L E F L P F S F G L A S S Y B I Y C K F H F S E O S J Y I E U U E I
U U Y F U E X J F K R U N X J N B O T T L E S D J E X P L A S T I C S C T
D P L D J F N J S G X A W V W R S C B U E J C J F K D U H S S G S S I M X
H I G L N U S Y T D U F I O O U S E S U A C K F I F O F O X L S O S O D P
U N O D E N F H R Y K V R W H K G M L I R T V N G R E E N B M V N G J C P
R G N V N T N V U B O B N V U R U D N F F J H F J J D H H Y J G R E E E O
F T N H G T T J G J D G M Y E J K M J H T T R R R Y I I O I U Y R D T G L
Y G B E R T H S D F G H W E V O L P T C L D W A U U O G J Q V F H K S H Y
J N E K B K I J J I T G O D F G H C F H J B F J H V I Y V F M H J S D F E
A I I O O D F Y I R Y I R E C Y C L I N G C O U G E T J D Y I O U D J F T
R F K O O O J I O U A A K I G I H B F I F A K I U F J F H A F O G U H I H
S H S U H A H F S N S H S F H E F E I Y U I W F K H C S L A O H S H K H Y
N H A U H K H I Y O I V C D P D F P F I F S H O S D V F A F I I Z P F L L
T H D J I F J I C K B V L D P E V S N L H V F H R E C Y C L I N G O B M E
D G J D G I Y K F N Z D O E O T K N L N V J V A U K H T G F F J J F T T N
H S F K S G R A S S Q K W N L H K R U O D K O J N I S O L T N Y E D C A E
T F J J V N R Y F B J H F S Y Y H A G J B B H V F U E K H D K I R T O D T
P V C D F H K R Y I C B M I H L I L F K D C T N V J G K N O J G N V O C T
O F K J L S J L S J L S J T S E L S J R S O O D I J D I C K D S L S L K E
L H R Q N Q U O R E U O C Y K N O I A F G K I P K F J K U K Y R U A I I R
Y J N D K D I K N P J L A O D E I C R N K E I F L H K U J Y J Y T O J V E
V D N X M C N A L U M I N U M J D J I R U S U S S Y O Y S I S E S S K F P
I S D K A D S F S D M V S U O D K D N S F K Y H S F H S F K M K D J S F T
N D K S J S F M M G B A H S D H D F K D D K W K D K A J A I D F S J K H H
Y V C S J P O L Y P R O P Y L E N E T T I N H T V R D W B M J Y B G C C A
L X N Y T F O K M J Y B G F C E S N Y V R C L M H V C O N U V R D W O J L
C D M N A V G D X W O U T G S C B M R H D P E G J H D P E N I J O K R L A
H T G Y H R J E O R I K R I K T F O L I E O T G P R G P F F P T O L R D T
L Y T V G H D H K S F A F K H S E S F G N L H I U Y S Y S A N A A D U A E
O R Y I O T F W H M A R K E T J L E W H S Y Y I K R S E V A E S S I G I E
R I J L D O K R A L E F I J L J L Y L D I M L F C I U K R O E S I L A O R
I T I K K H P L F S L F D R P L T R K K T L E L F B C E E V B I R A T I P
D K L U K Q M J H B T H K J N G V O I U Y T N L I U Y B A R O D K U E H A
E M T N H B G L K J N E T F I J Y T R L I M E H G I U E H T F S M H D I P
E U G F N E W S P R I N T F L H F E I T Y T R E J N L C J G D U G D N J E
X G D K H V X M J B V R D K U Y B T E F D I M T J B G V C S K J N H T V R
D M J Y B G F C E I M U Y B P O L Y S T Y R E N E D I M U T F E I M U H F
```

Find the following words:

Low Density Polyethylene
High Density Polyethylene
Brown
Clear
Green
Plastics
PET
Polyethylene terepthalate
PVC
Polyvinylchloride
Paper

Polystyrene
Market
Recycling Works
Cardboard
Tin
Polypropylene
Steel
Jars
Bottles

Yardwaste
BONUS: RECYCLING WORKS

Glass
Cullet
HDPE
Leaves
Newsprint
Grass
Bimetal

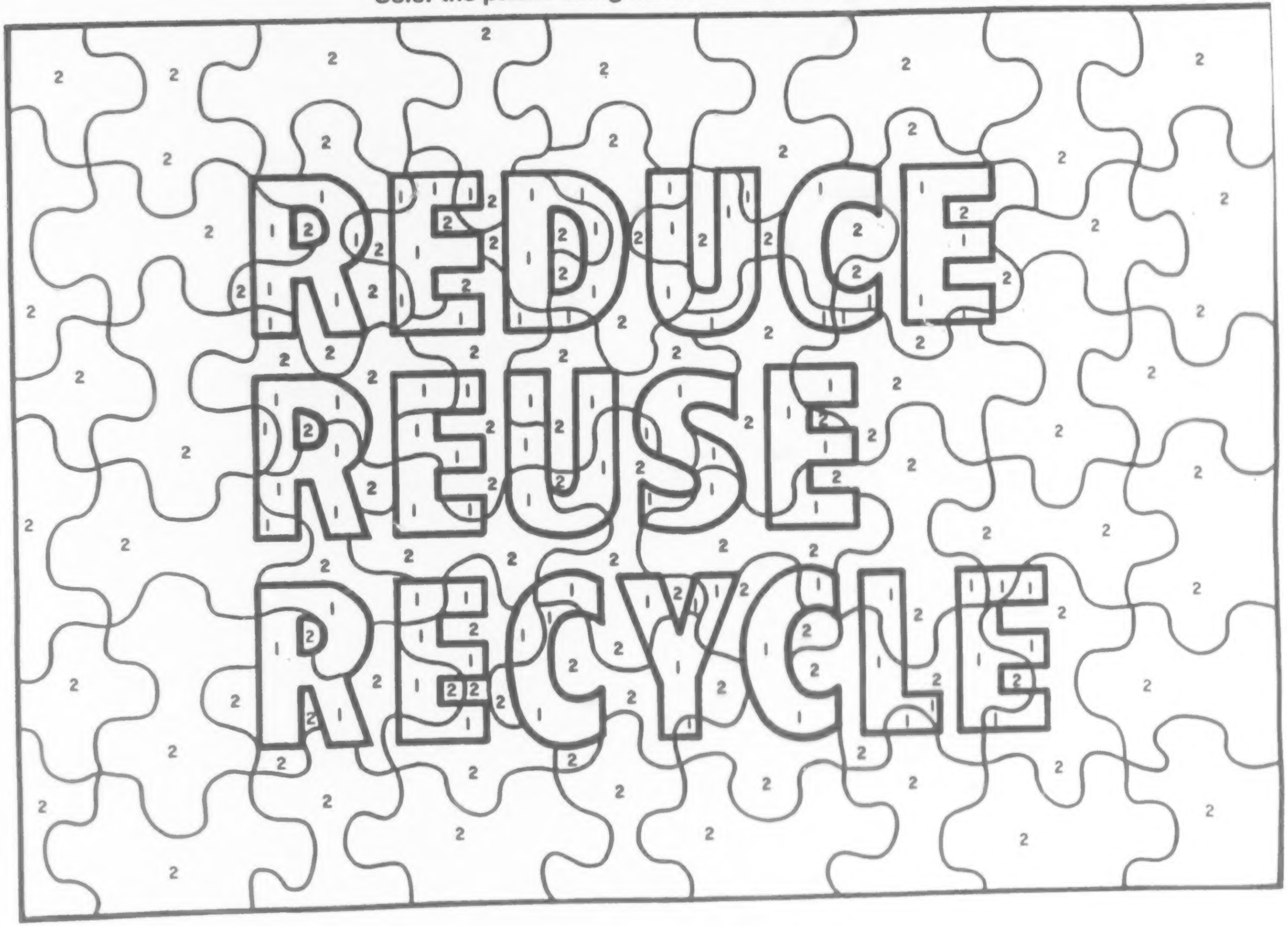
Aluminum
Cans
LDPE

FIND THE RECYCLING WORDS

```
C G I L E F L P F S F G L A S S Y B I Y C K F H F S E O S J Y I E U U E I
U U Y F U E X J F K R U N X J N B O T T L E S D J E X P L A S T I C S C T
D P L D J F N J S G X A W V W R S C B U E J C J F K D U H S S G S S I M X
H I G L N U S Y T D U F I O O U S E S U A C K F I F O F O X L S O S O D P
U N O D E N F H R Y K V R W H K G M L I R T V N G R E E N B M V N G J C P
R G N V N T N V U B O B N V U R U D N F F J H F J J D H H Y J G R E E E O
F T N H G T T J G J D G M Y E J K M J H T T R R R Y I I O I U Y R D T G L
Y G B E R T H S D F G H W E V O L P T C L D W A U U O G J Q V F H K S H Y
J N E K B K I J J I T G O D F G H C F H J B F J H V I Y V F M H J S D F E
A I I O O D F Y I R Y I R E C Y C L I N G C O U G E T J D Y I O U D J F T
R F K O O O J I O U A A K I G I H B F I F A K I U F J F H A F O G U H I H
S H S U H A H F S N S H S F H E F E I Y U I W F K H C S L A O H S H K H Y
N H A U H K H I Y O I V C D P D F P F I F S H O S D V F A F I I Z P F L L
T H D J I F J I C K B V L D P E V S N L H V F H R E C Y C L I N G O B M E
D G J D G I Y K F N Z D O E O T K N L N V J V A U K H T G F F J J F T T N
H S F K S G R A S S Q K W N L H K R U O D K O J N I S O L T N Y E D C A E
T F J J V N R Y F B J H F S Y Y H A G J B B H V F U E K H D K I R T O D T
P V C D F H K R Y I C B M I H L I L F K D C T N V J G K N O J G N V O C T
O F K J L S J L S J L S J T S E L S J R S O O D I J D I C K D S L S U K E
L H R Q N Q U O R E U O C Y K N O I A F G K I P K F J K U K Y R U A I I R
Y J N D K D I K N P J L A O D E I C R N K E I F L H K U J Y J Y T O J V E
V D N X M C N A L U M I N U M J D J I R U S U S S Y O Y S I S E S S K F P
I S D K A D S F S D M V S U O D K D N S F K Y H S F H S F K M K D J S F T
N D K S J S F M M G B A H S D H D F K D D K W K D K A J A I D F S J K H H
Y V C S J P O L Y P R O P Y L E N E T T I N H T V R D W B M J Y B G C C A
L X N Y T F O K M J Y B G F C E S N Y V R C L M H V C O N U V R D W O J L
C D M N A V G D X W O U T G S C B M R H D P E G J H D P E N I J O K R L A
H T G Y H R J E O R I K R I K T F O L I E O T G P R G P F F P T O L R D T
L Y T V G H D H K S F A F K H S E S F G N L H I U Y S Y S A N A A D U A E
O R Y I O T F W H M A R K E T J L E W H S Y Y I K R S E V A E S S I G I E
R I J L D O K R A L E F I J L J L Y L D I M L F C I U K R O E S I L A O R
I T I K K H P L F S L F D R P L T R K K T L E L F B C E E V B I R A T I P
D K L U K Q M J H B T H K J N G V O I U Y T N L I U Y B A R O D K U E H A
E M T N H B G L K J N E T F I J Y T R L I M E H G I U E H T F S M H D I P
E U G F N E W S P R I N T F L H F E I T Y T R E J N L C J G D U G D N J E
X G D K H V X M J B V R D K U Y B T E F D I M T J B G V C S K J N H T V R
D M J Y B G F C E I M U Y B P O L Y S T Y R E N E D I M U T F E I M U H F
```

Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

Color the puzzle using the code below. What does it say?


REDUCE
REUSE
RECYCLE

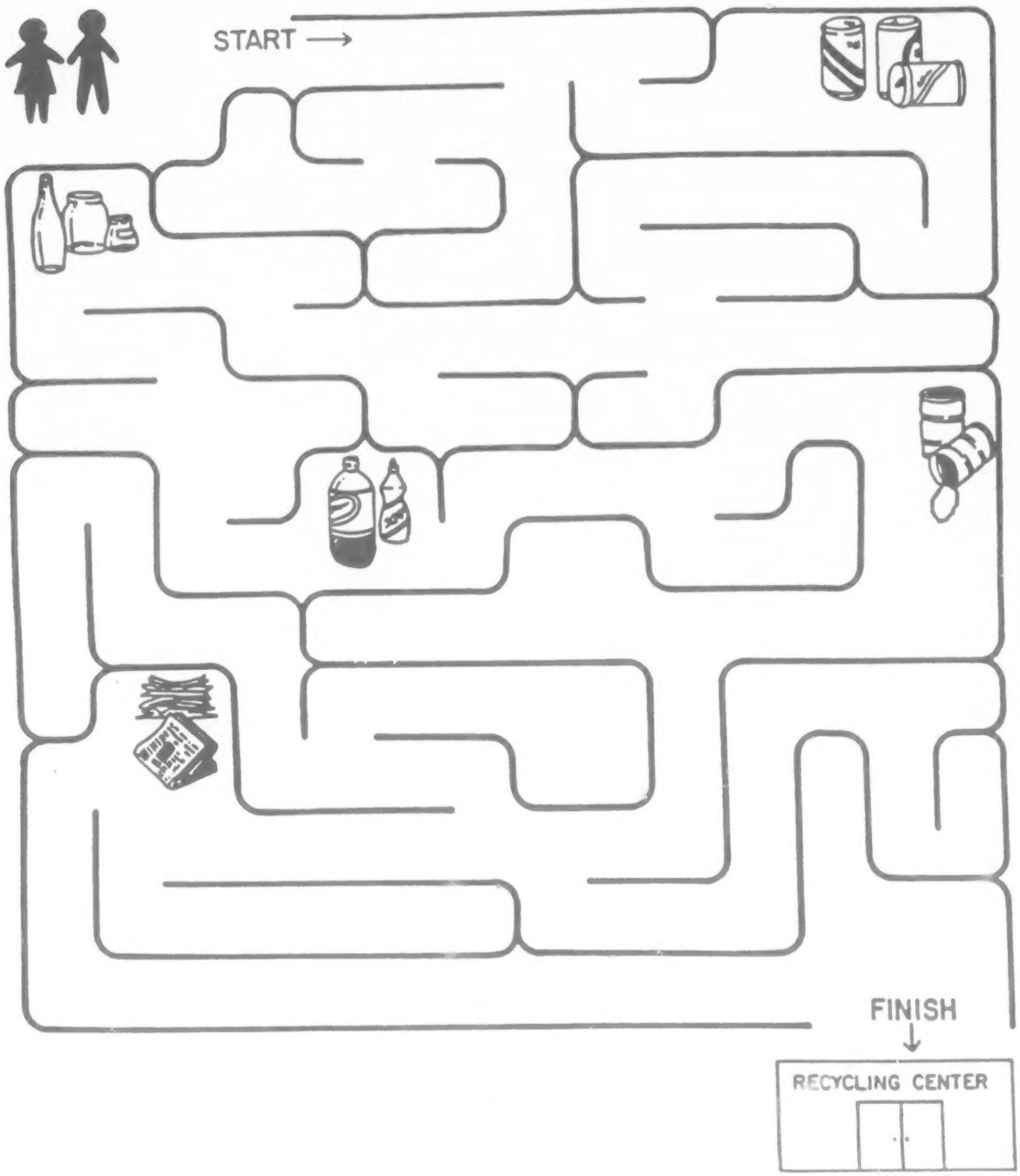
1 = YELLOW

2 = BLUE

Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

RECYCLING MAZE

Help the recycling twins, Sam and Susie, collect the recyclables and take them to the recycling center. What are the recyclables? What can they be made into? The answers are on the back.


START →
FINISH
↓
RECYCLING CENTER

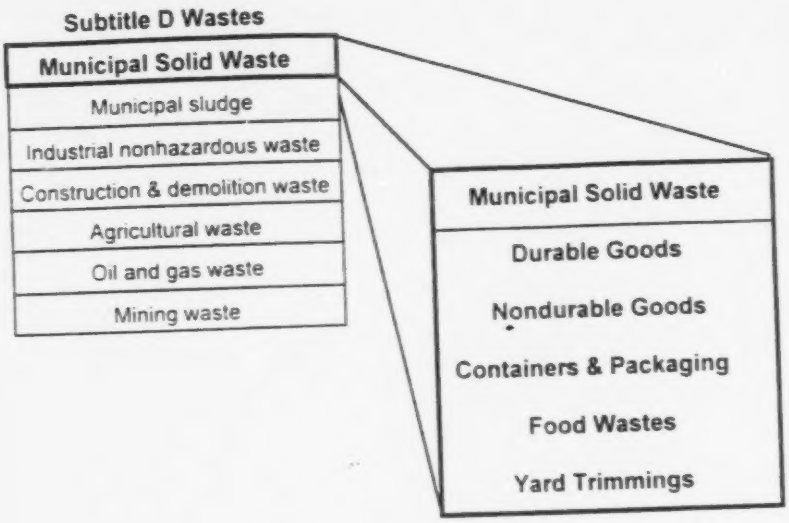
Source:
Pennsylvania Recycling and Waste Reduction Curriculum Activities

TABLES
&
CHARTS

Courtesy of:

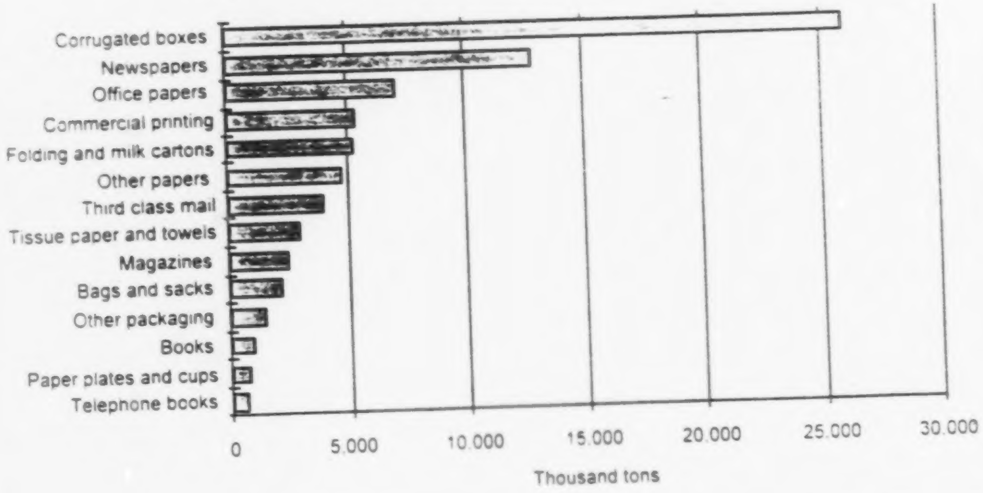
United States Environmental Protection Agency
Municipal Solid Waste Factbook, V.1.2
May 1994

Figure 1. Municipal solid waste in the universe of Subtitle D wastes


Subtitle D Wastes
Municipal Solid Waste
Municipal sludge
Industrial nonhazardous waste
Construction & demolition waste
Agricultural waste
Oil and gas waste
Mining waste
Municipal Solid Waste
Durable Goods
Nondurable Goods
Containers & Packaging
Food Wastes
Yard Trimmings

Note: Conditionally Exempt Small Quantity Generator waste can also be managed in a Subtitle D landfill or combustor.

Figure 2. Paper and paperboard products generated in MSW, 1993



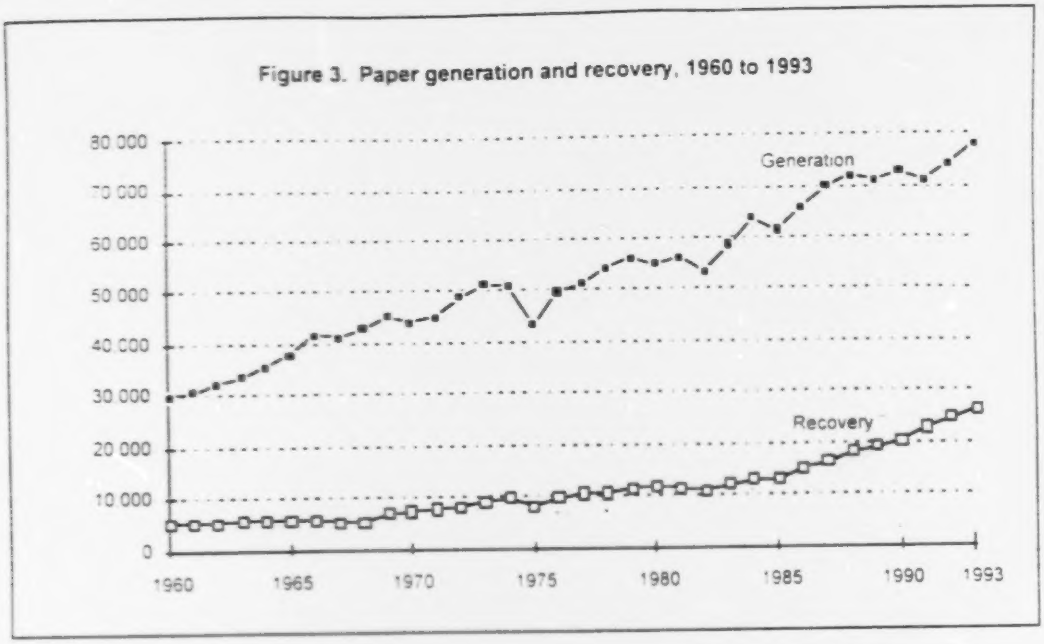


Figure 3. Paper generation and recovery, 1960 to 1993

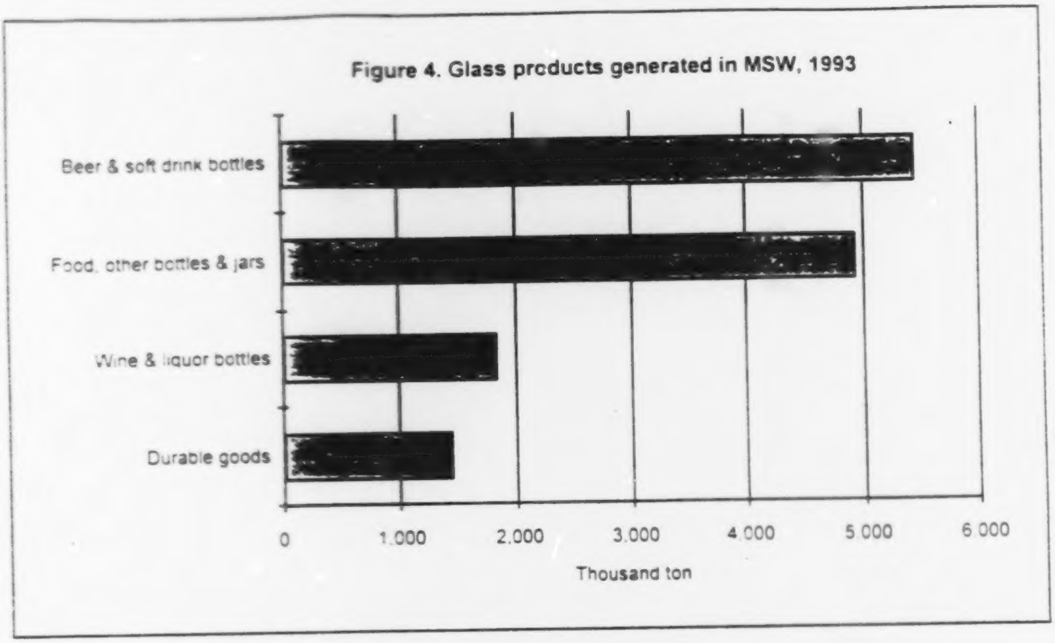


Figure 4. Glass products generated in MSW, 1993

Figure 5. Glass generation and recovery, 1960 to 1993

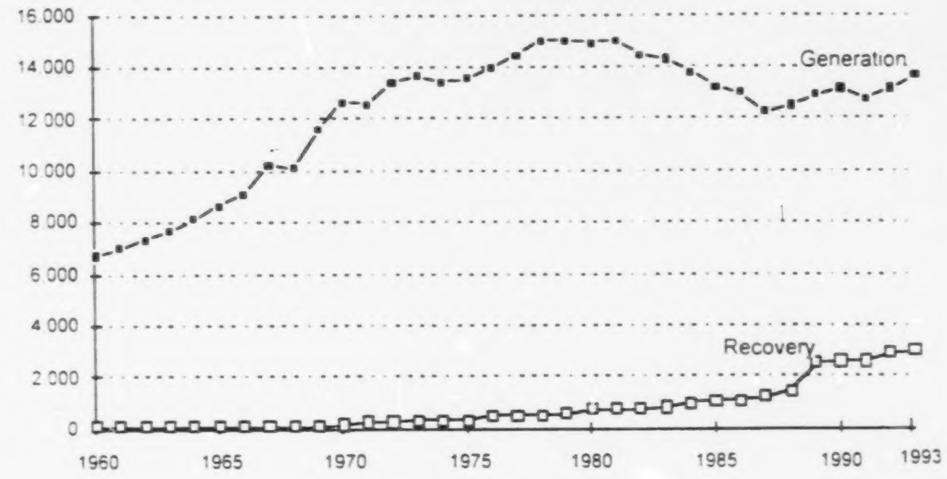


Figure 6. Metal products generated in MSW, 1993

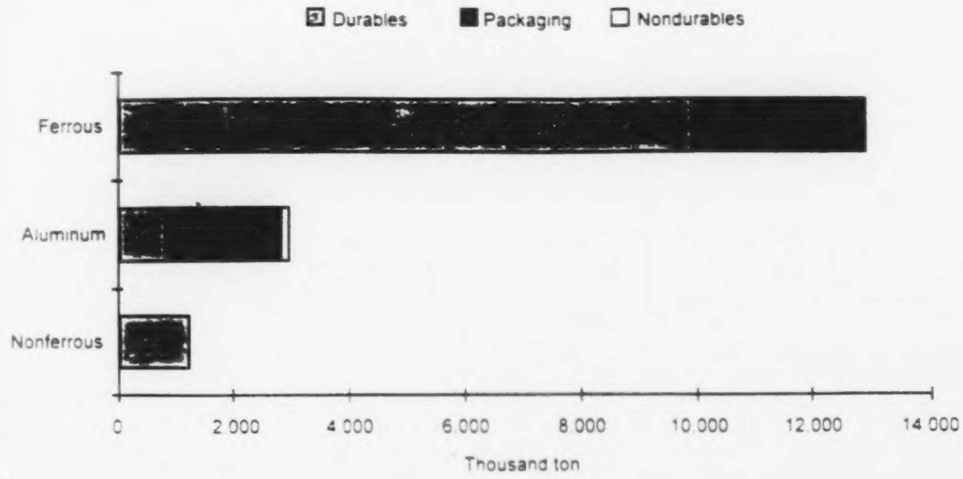


Figure 7. Metals generation and recovery, 1960 to 1993

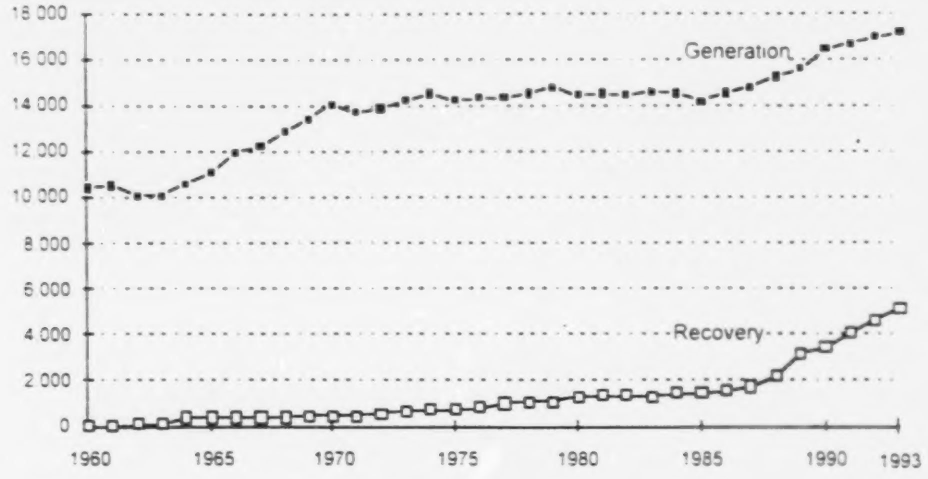


Figure 8. Plastics products generated in MSW, 1993

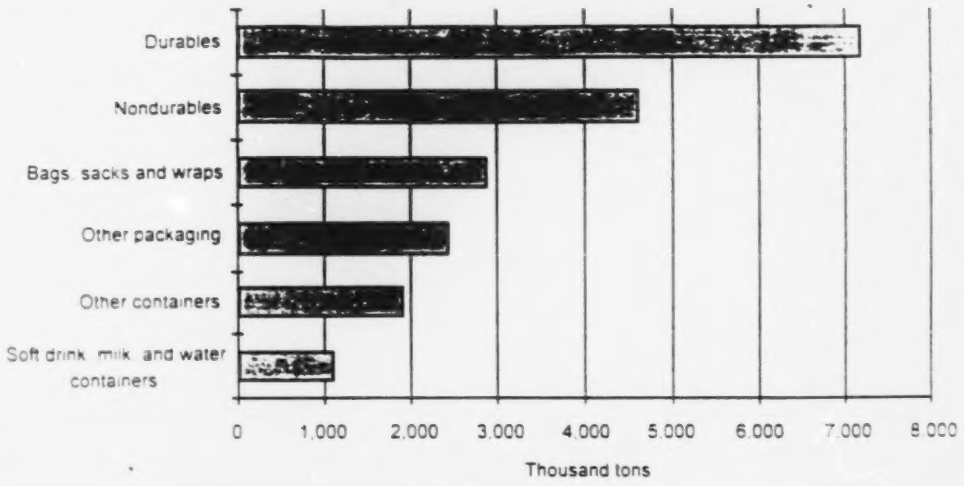


Figure 9. Plastics generation and recovery, 1960 to 1993

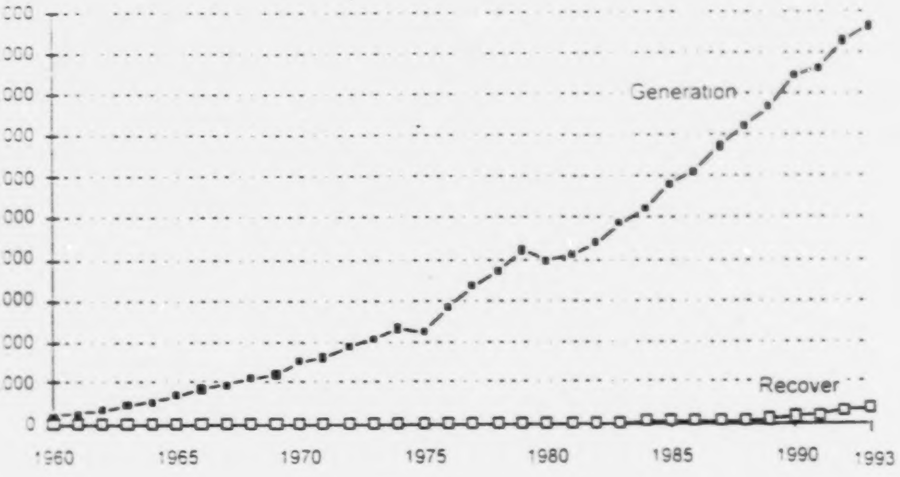


Figure 10. Generation of materials in MSW, 1960 to 1993

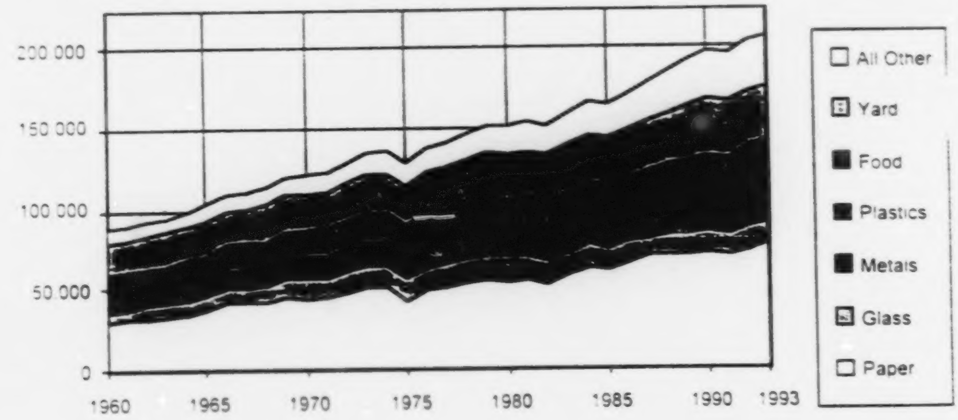


Figure 11. Materials recovery and discards of MSW, 1960 to 1993

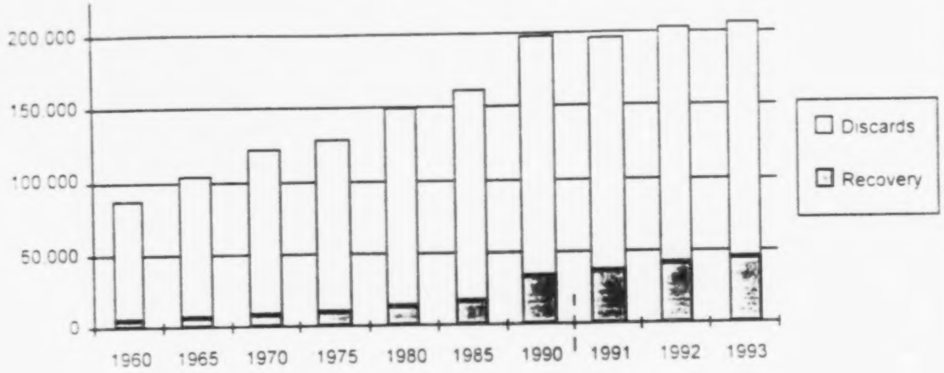
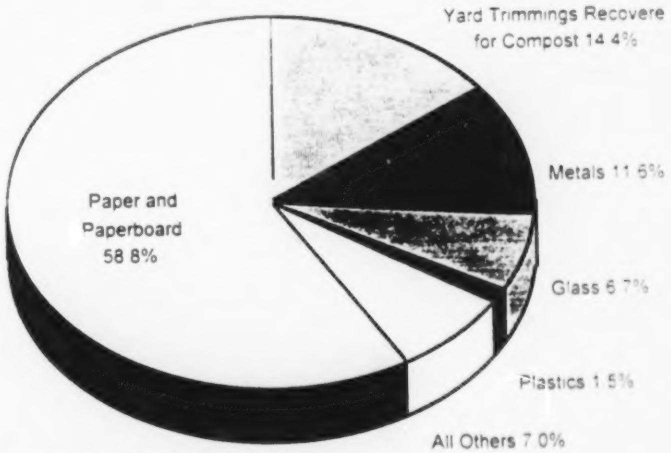
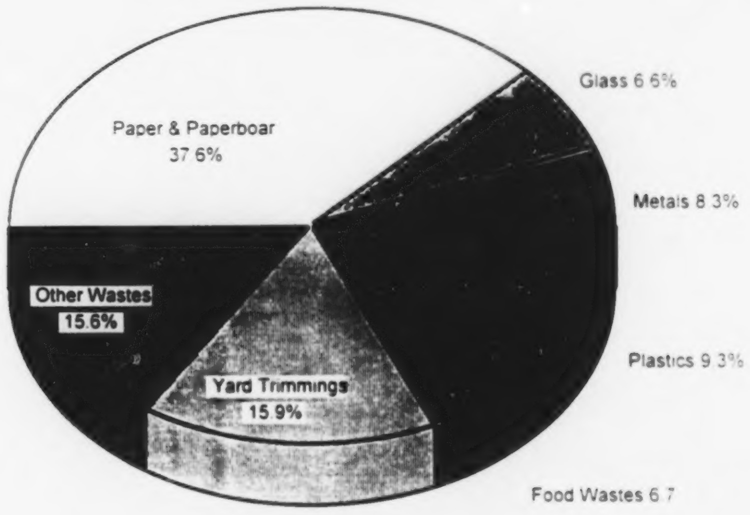


Figure 12. Materials recovery*, 1993

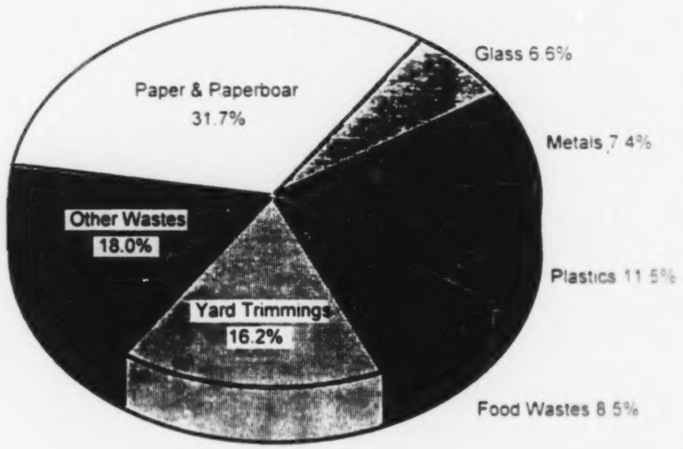


* In percent by weight of total recovery

Figure 13. Materials generated and discarded in municipal solid waste, 1993
(in percent of total generation and discards)

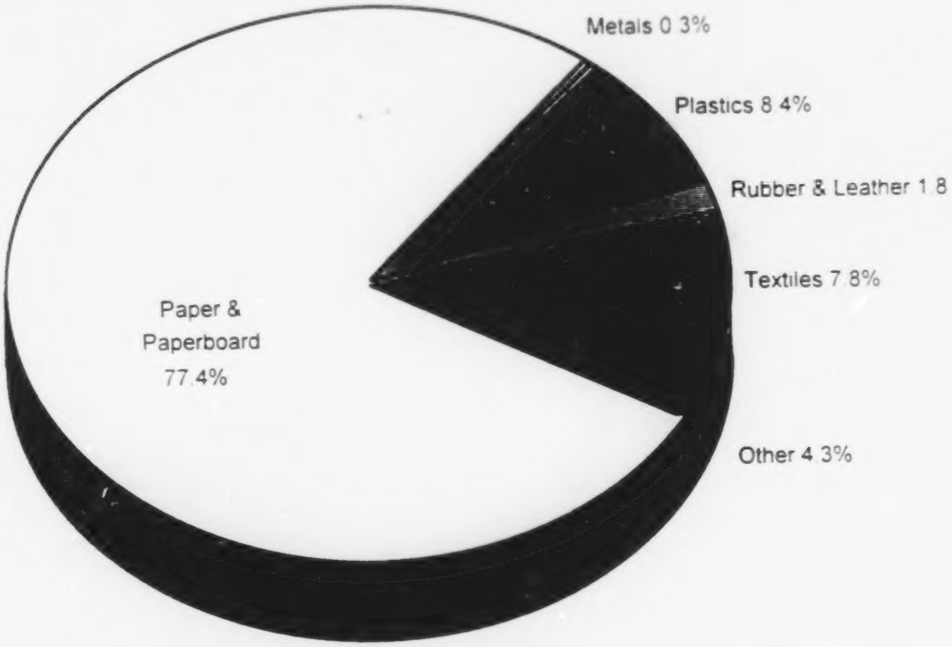


Generation

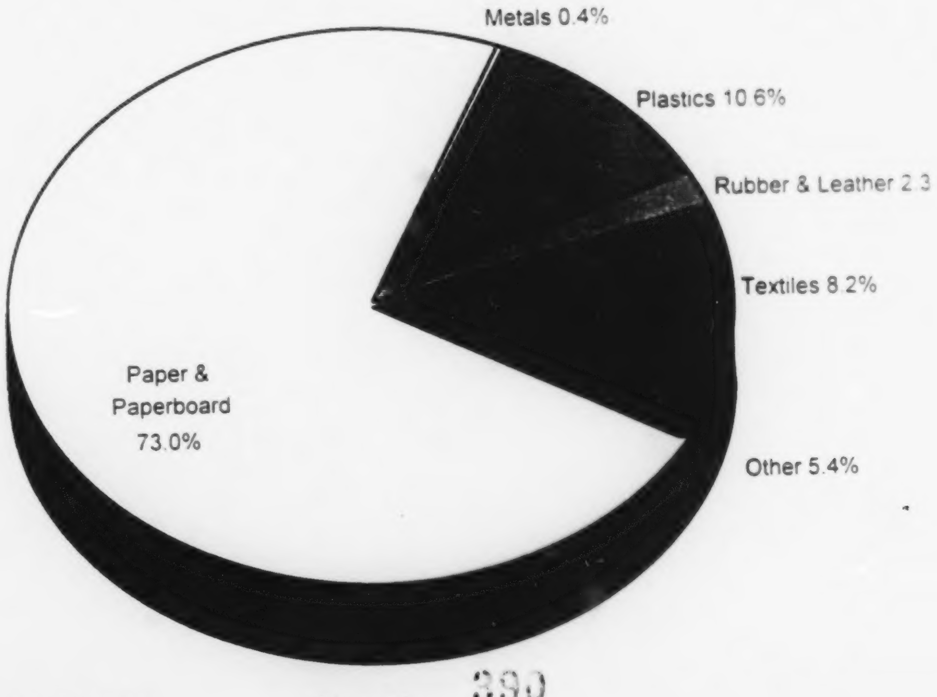


Discards

Figure 15. Nondurable goods generated and discarded in municipal solid waste, 1993
(in percent of total generation and discards)

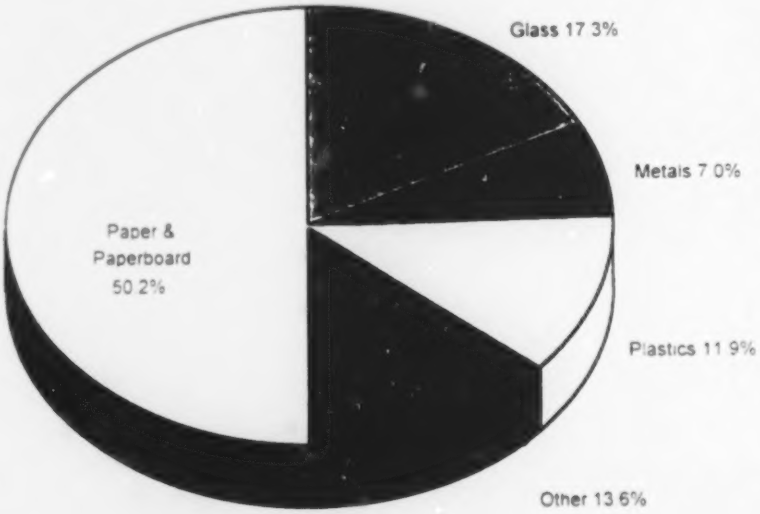


Generation

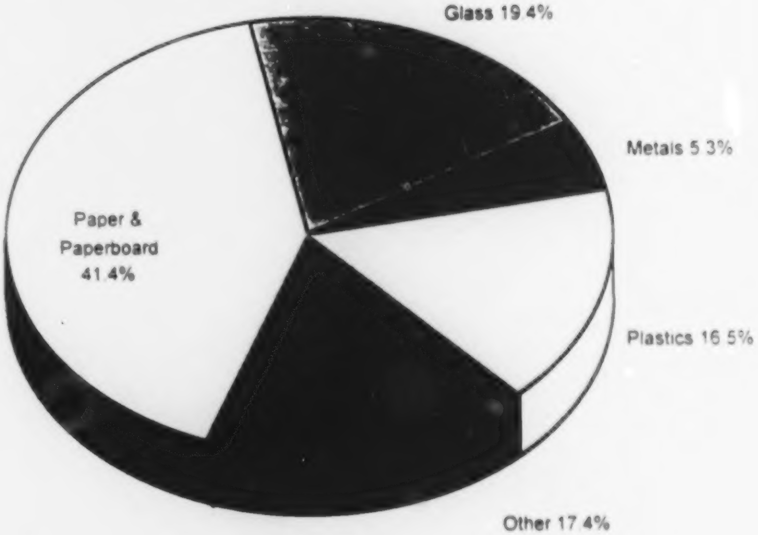


Discards

Figure 16. Containers and packaging generated and discarded in municipal solid waste, 1993
(in percent of total generation and discards)

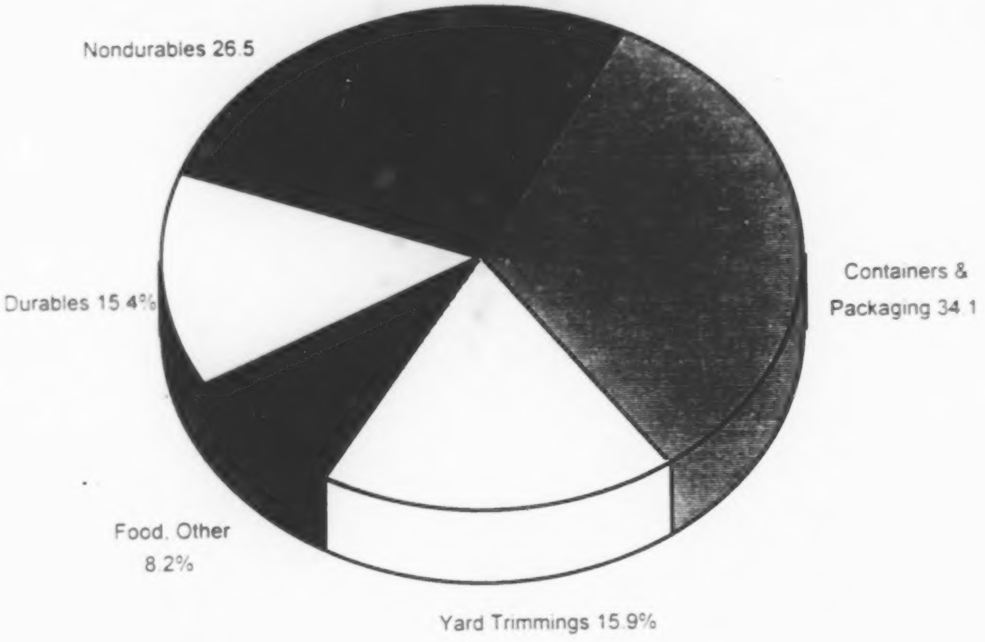


Generation

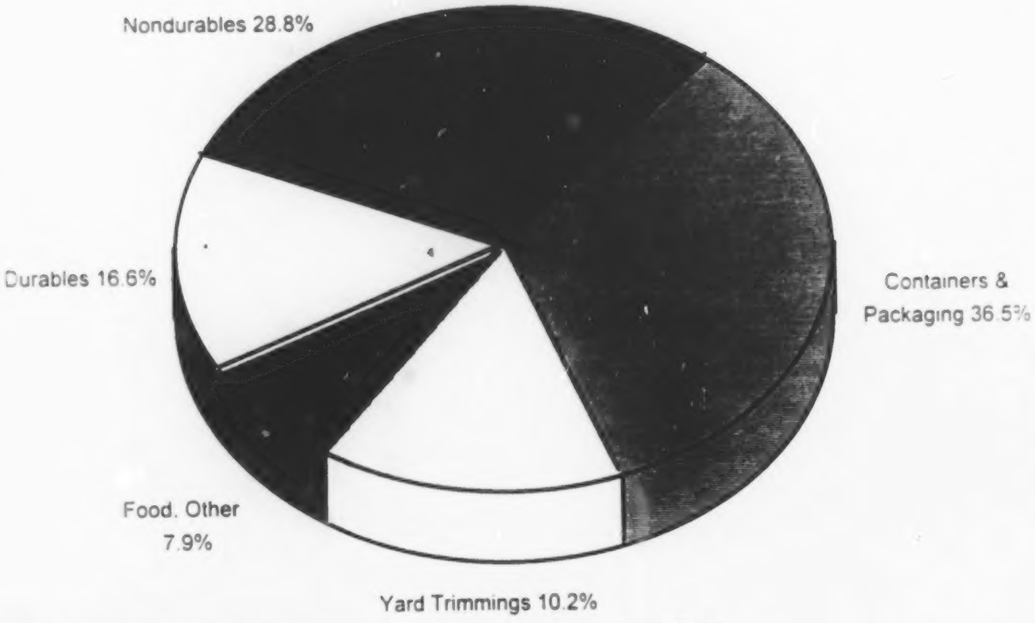


Discards

Figure 19. Products generated in MSW, 1993 and 2000
(in percent of total generation)



1993



2000

Figure 14. Generation of products in MSW, 1960 to 1993

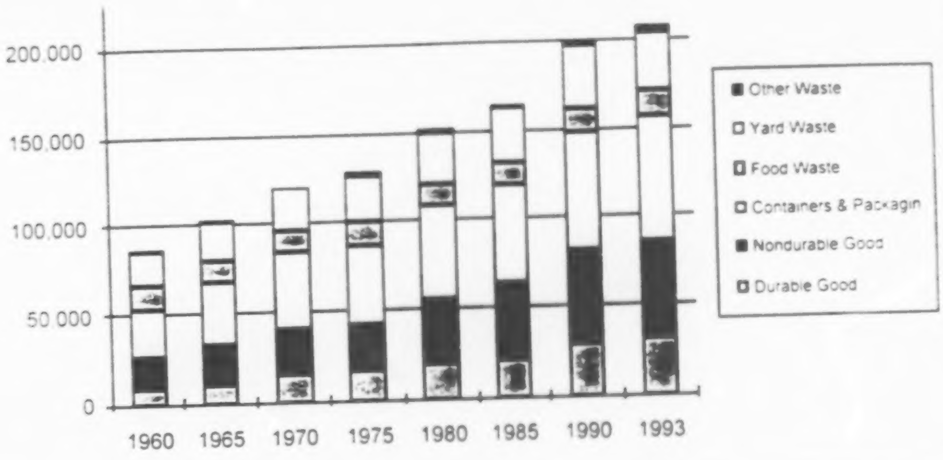


Table 5

GLASS PRODUCTS IN MSW, 1993
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery		Discards (Thousand tons)
		(Thousand tons)	(Percent of generation	
Durable Goods*	1,440	Neg.	Neg.	1,440
Containers and Packaging				
Beer and Soft Drink Bottles	5,440	1,600	29.4%	3,840
Wine and Liquor Bottles	1,850	450	24.3%	1,400
Food and Other Bottles and Jars	4,940	960	19.4%	3,980
Total Glass Containers	12,230	3,010	24.6%	9,220
Total Glass	13,670	3,010	22.0%	10,660

* Glass as a component of appliances, furniture, consumer electronics, etc.
Neg. = Negligible.
Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Table 8

RUBBER AND LEATHER PRODUCTS IN MSW, 1993
(In thousands of tons and percent of generation)

Product Category	Generation (Thousand tons)	Recovery		Discards (Thousand tons)
		(Thousand tons	(Percent of generation	
Durable Goods				
Rubber Tires*	2,870	370	12.9%	2,500
Other Durables**	2,350	Neg.	Neg.	2,350
Total Rubber & Leather Durable Goods	5,220	370	7.1%	4,850
Nondurable Goods				
Clothing and Footwear	730	Neg.	Neg.	730
Other Nondurables	260	Neg.	Neg.	260
Total Rubber & Leather Nondurable Goods	990	Neg.	Neg.	990
Containers and Packagin	10	Neg.	Neg.	10
Total Rubber & Leather	6,220	370	5.9%	5,850

* Does not include other materials in tires.
** Includes carpets and rugs and other miscellaneous durables.
Neg. = Negligible.
Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Table 9

CATEGORIES OF PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 1993

(In thousands of tons and percent of total generation)

	Thousands of Tons						
Products	**1960**	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**
Durable Goods *(Detail in Table 12)*	9,430	15,090	19,700	29,710	30,260	30,630	31,910
Nondurable Goods *(Detail in Table 15)*	17,550	25,540	36,490	52,450	50,000	52,750	54,800
Containers and Packaging *(Detail in Table 18)*	27,320	43,470	52,350	64,760	65,260	68,130	70,580
Total Product** Wastes	54,300	84,100	108,540	146,920	145,520	151,510	157,290
Other Wastes							
Food Wastes	12,200	12,800	13,200	13,200	13,300	13,500	13,800
Yard Trimmings	20,000	23,200	27,500	35,000	35,000	35,000	32,800
Miscellaneous Inorganic Wastes	1,300	1,780	2,250	2,900	2,950	3,000	3,050
Total Other Wastes	33,500	37,780	42,950	51,100	51,250	51,500	49,650
Total MSW Generated - Weight	87,800	121,880	151,490	198,020	196,770	203,010	206,940
	Percent of Total Generation						
Products	**1960**	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**
Durable Goods *(Detail in Table 12)*	10.7%	12.4%	13.0%	15.0%	15.4%	15.1%	15.4%
Nondurable Goods *(Detail in Table 15)*	20.0%	21.0%	24.1%	26.5%	25.4%	26.0%	26.5%
Containers and Packaging *(Detail in Table 19)*	31.1%	35.7%	34.6%	32.7%	33.2%	33.6%	34.1%
Total Product** Wastes	61.8%	69.0%	71.6%	74.2%	74.0%	74.6%	76.0%
Other Wastes							
Food Wastes	13.9%	10.5%	8.7%	6.7%	6.8%	6.6%	6.7%
Yard Trimmings	22.8%	19.0%	18.2%	17.7%	17.8%	17.2%	15.9%
Miscellaneous Inorganic Wastes	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%	1.5%
Total Other Wastes	38.2%	31.0%	28.4%	25.8%	26.0%	25.4%	24.0%
Total MSW Generated - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Generation before materials recovery or combustion. Does not include construction & demolition debris, industrial process wastes, or certain other wastes.

** Other than food products.

Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Table 21

RECOVERY* OF PRODUCTS IN MUNICIPAL SOLID WASTE, 1960 TO 1993
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of generation of each product)

	Percent of Generation of Each Product						
Products	**1960**	**1970**	**1980**	**1990**	**1991**	**1992**	**1993**
Durable Goods	3.7%	6.2%	6.9%	9.8%	10.7%	11.5%	12.7%
(Detail in Table 13)							
Nondurable Goods	13.6%	14.8%	13.2%	16.4%	20.6%	20.7%	21.0%
(Detail in Table 16)							
Containers and Packaging							
Glass Packaging							
Beer and Soft Drink Bottles	6.4%	2.5%	10.8%	33.2%	25.6%	28.3%	29.4%
Wine and Liquor Bottles	Neg.	Neg.	Neg.	10.0%	20.7%	23.5%	24.3%
Food and Other Bottles & Jars	Neg.	Neg.	Neg.	12.7%	19.6%	20.5%	19.4%
Total Glass Packaging	1.6%	1.3%	5.4%	22.0%	22.5%	24.6%	24.6%
Steel Packaging							
Beer and Soft Drink Cans	Neg.	Neg.	Neg.	26.7%	44.4%	50.0%	57.1%
Food and Other Cans	Neg.	2.0%	5.3%	23.2%	31.0%	39.8%	47.8%
Other Steel Packaging	Neg.	Neg.	Neg.	25.0%	21.1%	23.5%	21.1%
Total Steel Packaging	Neg.	1.7%	5.5%	23.5%	30.8%	39.1%	46.3%
Aluminum Packaging							
Beer and Soft Drink Cans	Neg.	Neg.	Neg.	63.2%	62.2%	67.9%	63.4%
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Foil and Closures	Neg.	Neg.	Neg.	9.1%	6.3%	9.1%	9.1%
Total Aluminum Pkg	Neg.	Neg.	Neg.	53.2%	52.3%	56.9%	53.0%
Paper & Paperboard Pkg							
Corrugated Boxes	33.9%	21.3%	36.8%	48.0%	50.2%	52.4%	55.5%
Milk Cartons**			Neg.	Neg.	Neg.	Neg.	Neg.
Folding Cartons**			Neg.	Neg.	13.0%	15.0%	14.2%
Other Paperboard Packaging	7.8%	11.0%	Neg.	Neg.	Neg.	Neg.	Neg.
Bags and Sacks**			Neg.	Neg.	13.6%	14.7%	15.9%
Wrapping Papers**			Neg.	Neg.	Neg.	Neg.	Neg.
Other Paper Packaging	7.5%	11.0%	36.5%	Neg.	Neg.	Neg.	Neg.
Total Paper & Board Pkg	21.3%	17.1%	27.2%	37.3%	39.6%	41.8%	44.2%
Plastics Packaging							
Soft Drink Bottles**			3.8%	32.6%	35.6%	41.2%	41.1%
Milk Bottles**			Neg.	3.8%	14.3%	23.1%	23.6%
Other Containers	Neg.	Neg.	Neg.	1.2%	4.0%	4.3%	4.7%
Bags and Sacks**			Neg.	3.2%	1.1%	2.1%	1.9%
Wraps**			Neg.	2.0%	0.6%	1.1%	1.6%
Other Plastics Packaging	Neg.	Neg.	Neg.	0.9%	0.5%	0.4%	0.4%
Total Plastics Packaging	Neg.	Neg.	Neg.	3.6%	4.4%	5.8%	6.2%
Wood Packaging	Neg.	Neg.	Neg.	5.1%	10.0%	12.0%	14.0%
Other Misc. Packaging	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Containers & Pkg	11.4%	9.0%	16.0%	26.5%	28.7%	30.9%	32.5%
Total Product Wastes†	10.8%	10.3%	13.4%	19.5%	22.2%	23.4%	24.5%
Other Wastes							
Food Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Yard Trimmings	Neg.	Neg.	Neg.	12.0%	14.3%	17.1%	19.8%
Miscellaneous Inorganic Wastes	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Total Other Wastes	Neg.	Neg.	Neg.	8.2%	9.8%	11.7%	13.1%
Total MSW Recovered - %	6.7%	7.1%	9.6%	16.6%	19.0%	20.4%	21.7%

* Recovery of postconsumer wastes; does not include converting/fabrication scrap.

** Not estimated separately prior to 1980.

† Other than food products.

Details may not add to totals due to rounding.

Neg. = Negligible.

Source: Franklin Associates, Ltd.

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Table 23

PRODUCTS DISCARDED* IN THE MUNICIPAL WASTE STREAM, 1960 TO 1993
(WITH DETAIL ON CONTAINERS AND PACKAGING)
(In percent of total discards)

Products	Percent of Total Discards						
	1960	1970	1980	1990	1991	1992	1993
Durable Goods *(Detail in Table 14)*	11.1%	12.5%	13.4%	16.2%	16.9%	16.8%	17.2%
Nondurable Goods *(Detail in Table 17)*	18.5%	19.2%	23.1%	26.5%	24.9%	25.9%	26.7%
Containers and Packaging							
Glass Packaging							
Beer and Soft Drink Bottles	1.6%	4.8%	4.4%	2.3%	2.5%	2.4%	2.4%
Wine and Liquor Bottles	1.3%	1.7%	1.8%	1.1%	0.9%	0.9%	0.9%
Food and Other Bottles & Jars	4.5%	3.9%	3.5%	2.2%	2.1%	2.2%	2.5%
Total Glass Packaging	7.4%	10.4%	9.7%	5.6%	5.5%	5.5%	5.7%
Steel Packaging							
Beer and Soft Drink Cans	0.8%	1.4%	0.4%	0.1%	0.0%	0.0%	0.0%
Food and Other Cans	4.6%	3.1%	2.0%	1.2%	1.3%	1.0%	0.9%
Other Steel Packaging	0.3%	0.2%	0.2%	0.1%	0.1%	0.1%	0.1%
Total Steel Packaging	5.7%	4.7%	2.5%	1.3%	1.4%	1.1%	1.0%
Aluminum Packaging							
Beer and Soft Drink Cans	0.1%	0.2%	0.7%	0.3%	0.4%	0.3%	0.4%
Other Cans	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.	Neg.
Foil and Closures	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Total Aluminum Pkg	0.2%	0.5%	0.9%	0.5%	0.6%	0.5%	0.6%
Paper & Paperboard Pkg							
Corrugated Boxes	5.9%	8.8%	7.8%	7.6%	7.5%	7.5%	7.2%
Milk Cartons**			0.4%	0.3%	0.3%	0.3%	0.3%
Folding Cartons**			2.7%	2.3%	2.5%	2.4%	2.6%
Other Paperboard Packaging	4.3%	3.8%	0.2%	0.2%	0.2%	0.2%	0.2%
Bags and Sacks**			2.5%	1.3%	1.2%	1.2%	1.1%
Wrapping Papers**			0.1%	0.1%	0.1%	0.0%	0.0%
Other Paper Packaging	3.3%	3.0%	0.6%	0.6%	0.7%	0.7%	0.7%
Total Paper & Board Pkg	13.5%	15.6%	13.8%	12.4%	12.5%	12.3%	12.2%
Plastics Packaging							
Soft Drink Bottles**			0.2%	0.2%	0.2%	0.2%	0.2%
Milk Bottles**			0.2%	0.3%	0.3%	0.2%	0.3%
Other Containers	0.1%	0.8%	0.6%	1.0%	1.0%	1.1%	1.1%
Bags and Sacks**			0.3%	0.6%	0.6%	0.6%	0.6%
Wraps**			0.6%	0.9%	1.1%	1.1%	1.1%
Other Plastics Packaging	0.1%	1.0%	0.6%	1.3%	1.4%	1.4%	1.5%
Total Plastics Packaging	0.1%	1.8%	2.5%	4.3%	4.5%	4.7%	4.8%
Wood Packaging	2.4%	1.8%	2.9%	4.5%	4.6%	4.9%	5.0%
Other Misc. Packaging	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Total Containers & Pkg	29.5%	34.9%	32.1%	28.8%	29.2%	29.2%	29.4%
Total Product Wastes†	59.1%	66.6%	68.6%	71.6%	71.0%	71.8%	73.4%
Other Wastes							
Food Wastes	14.9%	11.3%	9.6%	8.0%	8.3%	8.4%	8.5%
Yard Trimmings	24.4%	20.5%	20.1%	18.7%	18.8%	18.0%	16.2%
Miscellaneous Inorganic Wastes	1.6%	1.6%	1.6%	1.8%	1.8%	1.9%	1.9%
Total Other Wastes	40.9%	33.4%	31.4%	28.4%	29.0%	28.2%	26.6%
Total MSW Discarded - %	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

* Discards after materials and compost recovery. Does not include construction & demolition debris, industrial process wastes, or certain other wastes. Details may not add to totals due to rounding.

** Not estimated separately prior to 1980.

† Other than food products.

Neg. = Negligible.

Source: Franklin Associates, Ltd.

Table 24

REDUCTION IN WEIGHTS OF SOFT DRINK CONTAINERS, 1972 TO 1992

(in pounds per 100 containers)

	1972	1992	Percent Change
One-way glass bottle (16 fluid ounce)	75.7	48.04	- 36.5%
Steel can (12 fluid ounce)	10.5	7.19	- 31.5%
Aluminum can (12 fluid ounce)	4.5	3.51	- 22.0%
PET bottle (2 liter, one-piece)	14.6	11.95	-18.1%

Does not include weight of labels and caps. PET data for 1977 and 1992.

Source: Franklin Associates, Ltd.

COMPARISON OF SNACK FOOD PACKAGING, 1972 AND 1987

	1972	1987	Percent Change
Millions pounds of product	11,028	15,731	-42.6%
Million pounds of packaging	1, 243	1,134	- 8.8%
Pounds packaging 100 pounds of product	11.3	7.2	- 36.2%
Thousand cubic yards of packaging	1,536	1,391	- 9.4%

Does not include tertiary packaging (corrugated containers).

Source: Franklin Associates, Ltd.

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Table 25

GENERATION, MATERIALS RECOVERY, COMPOSTING, COMBUSTION, AND DISCARDS OF MUNICIPAL SOLID WASTE, 1960 TO 1993

(In thousands of tons and percent of total generation)

	Thousands of Tons						
	1960	1970	1980	1990	1991	1992	1993
Generation	87,800	121,880	151,490	198,020	196,770	203,010	206,940
Recovery for recycling	5,850	8,630	14,520	28,680	32,290	35,480	38,490
Recovery for composting*	0.0	0.0	0.0	4,200	5,000	6,000	6,500
Total Materials Recovery	5,850	8,630	14,520	32,880	37,290	41,480	44,990
Discards after recovery	81,950	113,250	136,970	165,140	159,480	161,530	161,950
Combustion**	27,000	25,100	13,700	31,900	33,330	32,690	32,920
Discards to landfill, other disposal†	54,950	88,150	123,270	133,240	126,150	128,840	129,030

	Percent of Total Generation						
	1960	1970	1980	1990	1991	1992	1993
Generation	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Recovery for recycling	6.7%	7.1%	9.6%	14.5%	16.4%	17.5%	18.6%
Recovery for composting*	0.0%	0.0%	0.0%	2.1%	2.5%	3.0%	3.1%
Total Materials Recovery	6.7%	7.1%	9.6%	16.6%	19.0%	20.4%	21.7%
Discards after recovery	93.3%	92.9%	90.4%	83.4%	81.0%	79.6%	78.3%
Combustion**	30.8%	20.6%	9.0%	16.1%	16.9%	16.1%	15.9%
Discards to landfill, other disposal†	62.6%	72.3%	81.4%	67.3%	64.1%	63.5%	62.4%

* Composting of yard trimmings and food wastes. Does not include backyard composting.

** Includes combustion of MSW in mass burn or refuse-derived form, incineration without energy recovery, and combustion with energy recovery of source separated materials in MSW.

† Discards after recovery minus combustion.

Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Figure 17. Municipal solid waste management, 1960 to 2000

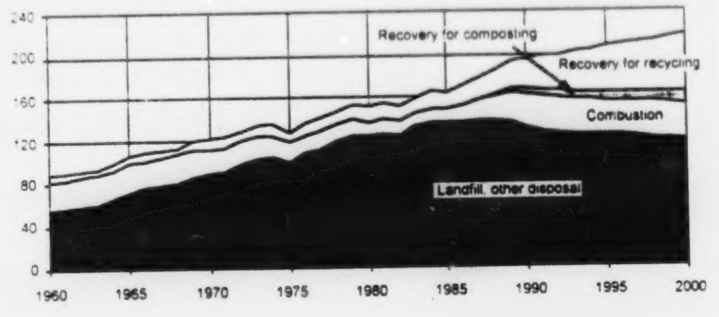

Table 26

PROJECTIONS OF MATERIALS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1993 AND 2000

(In thousands of tons and percent of total generation)

	Thousands of tons		% of total	
Materials	1993	2000	1993	2000
Paper and Paperboard	77,840	89,340	37.6%	41.0%
Glass	13,670	14,020	6.6%	6.4%
Metals				
Ferrous	12,930	14,220	6.2%	6.5%
Aluminum	2,970	3,425	1.4%	1.6%
Other Nonferrous	1,240	1,395	0.6%	0.6%
Total Metals	*17,140*	*19,040*	*8.3%*	*8.7%*
Plastics	19,300	22,490	9.3%	10.3%
Rubber and Leather	6,220	7,610	3.0%	3.5%
Textiles	6,130	6,200	3.0%	2.8%
Wood	13,690	16,010	6.6%	7.4%
Other	3,300	3,540	1.6%	1.6%
Total Materials in Products	157,290	178,250	76.0%	81.9%
Other Wastes				
Food Wastes	13,800	14,000	6.7%	6.4%
Yard Trimmings	32,800	22,200 **	15.9%	10.2%
Miscellaneous Inorganic Wastes	3,050	3,300	1.5%	1.5%
Total Other Wastes	49,650	39,500	24.0%	18.1%
Total MSW Generated	206,940	217,750	100.0%	100.0%

* Generation before materials recovery or combustion.

** This scenario assumes a 32.3% reduction of yard trimmings. See Table 32 for other scenarios.

* Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Figure 18. Materials generated in MSW, 1993 and 2000
(in percent of total generation)

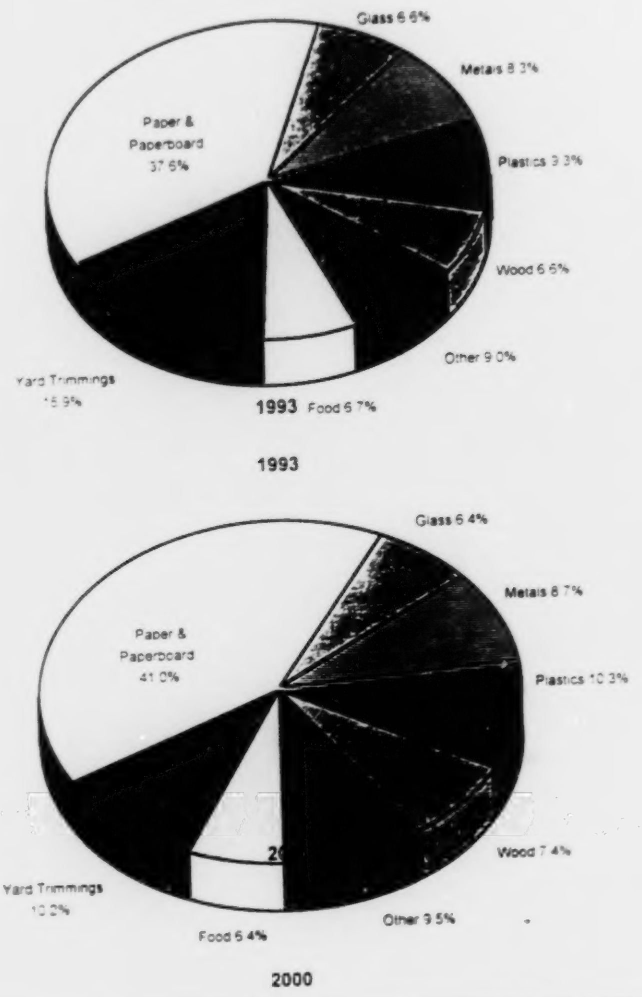

Table 27

AVERAGE ANNUAL RATES OF INCREASE (OR DECREASE)*
OF GENERATION OF MATERIALS IN MSW
(In annual percent by weight)

	1960-1970	1970-1980	1980-1990	1990-2000
Paper & Paperboard	4.0%	2.2%	2.9%	2.1%
Glass	6.6%	1.7%	-1.2%	0.6%
Metals	3.0%	0.2%	1.3%	1.5%
Plastics	22.5%	9.9%	8.4%	2.5%
Wood	2.8%	5.5%	6.2%	2.7%
All Other Materials**	4.3%	4.3%	3.9%	1.9%
Food Wastes	0.5%	0.3%	0.0%	0.6%
Yard Trimmings	1.5%	1.7%	2.4%	-4.5%
Total MSW	3.3%	2.2%	2.7%	1.0%
Population	1.2%	1.1%	1.0%	1.0%

* Annual rates of increase or decrease calculated on 10-year end points

** Rubber and leather, textiles, electrolytes in batteries, wood pulp and moisture in disposable diapers, miscellaneous inorganics

Source: Franklin Associates, Ltd

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Table 28

PROJECTIONS OF CATEGORIES OF PRODUCTS GENERATED* IN THE MUNICIPAL WASTE STREAM, 1993 AND 2000

(In thousands of tons and percent of total generation)

	Thousands of tons		% of total	
Products	1993	2000	1993	2000
Durable Goods *(Detail in Table 29)*	31,910	36,110	15.4%	16.6%
Nondurable Goods *(Detail in Table 30)*	54,800	62,760	26.5%	28.8%
Containers and Packaging *(Detail in Table 31)*	70,580	79,380	34.1%	36.5%
Total Product Wastes**	157,290	178,250	76.0%	81.9%
Other Wastes				
Food Wastes	13,800	14,000	6.7%	6.4%
Yard Trimmings	32,800	22,200	15.9%	10.2%
Miscellaneous Inorganic Wastes	3,050	3,300	1.5%	1.5%
Total Other Wastes	49,650	39,500	24.0%	18.1%
Total MSW Generated	206,940	217,750	100.0%	100.0%

* Generation before materials recovery or combustion.

** Other than food products.

This scenario assumes a 32.3% reduction of yard trimmings. See Table 32 for other scenarios.

Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Table 30

PROJECTIONS OF PRODUCTS GENERATED*
IN THE MUNICIPAL WASTE STREAM, 1993 AND 2000
(WITH DETAIL ON NONDURABLE GOODS)
(In thousands of tons and percent of total generation)

	Thousands of tons		% of total	
Products	1993	2000	1993	2000
Durable Goods *(Detail in Table 29)*	31,910	36,110	15.4%	16.6%
Nondurable Goods				
Newspapers	12,940	14,400	6.3%	6.6%
Books	990	1,180	0.5%	0.5%
Magazines	2,500	3,000	1.2%	1.4%
Office Papers	7,120	8,500	3.4%	3.9%
Telephone Books	740	870	0.4%	0.4%
Third Class Mail	4,010	4,700	1.9%	2.2%
Other Commercial Printing	5,440	6,400	2.6%	2.9%
Tissue Paper and Towels	3,010	3,500	1.5%	1.6%
Paper Plates and Cups	830	840	0.4%	0.4%
Plastic Plates and Cups	350	400	0.2%	0.2%
Trash Bags	890	1,020	0.4%	0.5%
Disposable Diapers	2,700	2,850	1.3%	1.3%
Other Nonpackaging Paper	4,770	5,400	2.3%	2.5%
Clothing and Footwear	4,280	4,800	2.1%	2.2%
Towels, Sheets, & Pillowcases	720	800	0.3%	0.4%
Other Misc. Nondurables	3,510	4,100	1.7%	1.9%
Total Nondurable Goods	54,800	62,760	26.5%	28.8%
Containers and Packaging *(Detail in Table 31)*	70,580	79,380	34.1%	36.5%
Total Product Wastes**	157,290	178,250	76.0%	81.9%
Other Wastes				
Food Wastes	13,800	14,000	6.7%	6.4%
Yard Trimmings	32,800	22,200	15.9%	10.2%
Miscellaneous Inorganic Wastes	3,050	3,300	1.5%	1.5%
Total Other Wastes	49,650	39,500	24.0%	18.1%
Total MSW Generated	206,940	217,750	100.0%	100.0%

* Generation before materials recovery or combustion.

** Other than food products.

This scenario assumes a 32.3% reduction of yard trimmings. See Table 32 for other scenarios.

Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Table 34

PROJECTIONS OF MATERIALS DISCARDED* IN MSW, 1993 AND 2000 (AT A 30 PERCENT RECOVERY SCENARIO IN 2000)

(In thousands of tons and percent of total discards)

	Thousand tons		% of discards	
Materials	1993	2000**	1993	2000
Paper and Paperboard	51,380	51,860	31.7%	34.0%
Glass	10,660	9,680	6.6%	6.4%
Metals				
Ferrous	9,560	9,085	5.9%	6.0%
Aluminum	1,920	1,850	1.2%	1.2%
Other Nonferrous	460	480	0.3%	0.3%
Total Metals	*11,940*	*11,415*	*7.4%*	*7.5%*
Plastics	18,620	20,515	11.5%	13.5%
Rubber & Leather	5,850	6,945	3.6%	4.6%
Clothing, Other Textiles	5,410	5,720	3.3%	3.8%
Wood	12,370	14,330	7.6%	9.4%
Yard Trimmings†	26,300	11,545	16.2%	7.6%
Food Wastes	13,800	13,480	8.5%	8.8%
Other Materials‡	5,620	6,840	3.5%	4.5%
Totals	161,950	152,330	100.0%	100.0%

* Discards after recovery for recycling and composting of yard trimmings.

** Recovery scenario at 30 percent (Table 33).

† Yard trimmings generation reduced in this scenario (Table 32).

‡ Miscellaneous inorganic wastes, electrolytes in batteries, other miscellaneous.

Details may not add to totals due to rounding.

Source: Franklin Associates, Ltd.

Table 36

PER CAPITA GENERATION, MATERIALS RECOVERY, COMBUSTION, AND DISCARDS OF MUNICIPAL SOLID WASTE, 1960 TO 2000

(In pounds per person per day; population in thousands)

	1960	1970	1980	1990	1993	2000
Generation	2.66	3.27	3.65	4.35	4.39	4.32
Recovery for recycling & composting	0.18	0.23	0.35	0.72	0.96	1.30
Discards after recovery	2.48	3.04	3.30	3.63	3.44	3.02
Combustion	0.82	0.67	0.33	0.70	0.70	0.67
Discards to landfill, other disposal	1.67	2.37	2.97	2.93	2.74	2.35
Population (thousands)	180,671	203,984	227,255	249,399	257,908	276,241

The year 2000 scenario assumes substantial reduction of yard trimmings generation, a 30% recovery scenario, and virtually no increase in net combustion of MSW.

Details may not add to totals due to rounding.

Population figures from Bureau of the Census, Current Population Reports.

Source: Franklin Associates, Ltd.

Figure ES-1. Materials generated in MSW by weight, 1993
(Total weight = 206.9 million tons)

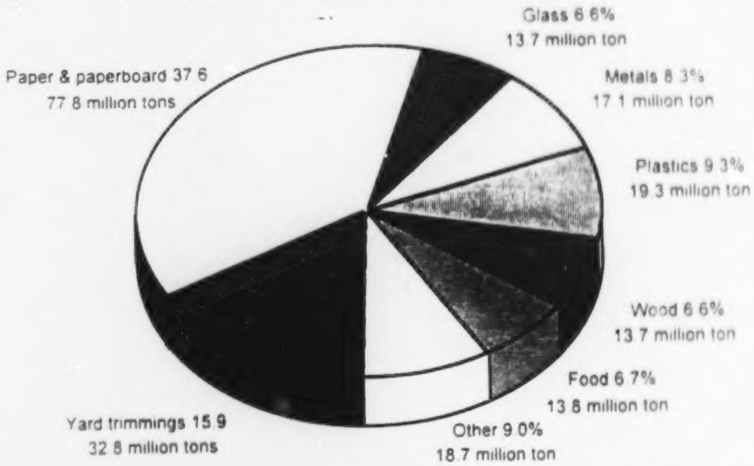

Figure ES-3. Management of MSW in U.S., 1993
(Total weight = 206.9 million tons)

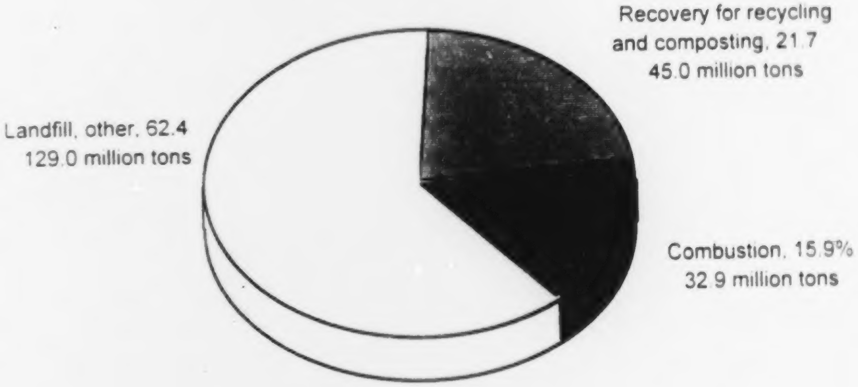

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Figure ES-5. Landfill volume of materials in MSW, 1993 (in percent of total)

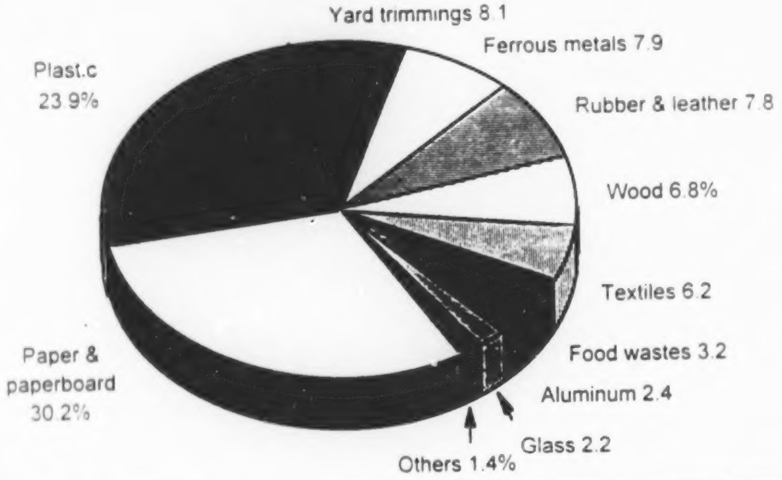


Figure ES-6. Landfill volume of products in MSW, 1993 (in percent of total)

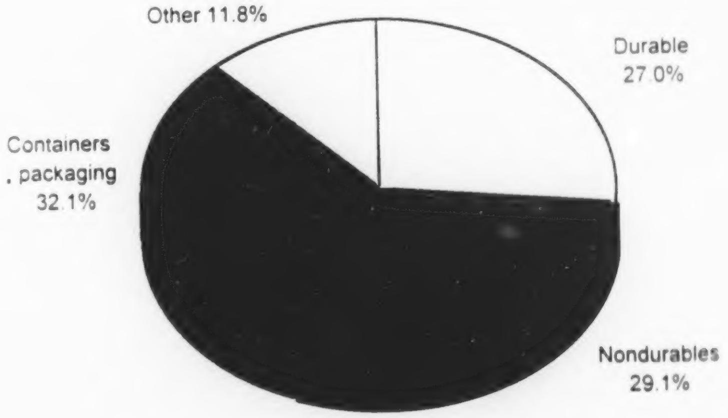


Figure ES-7. U.S. population and municipal solid waste generation, 1960 to 1993

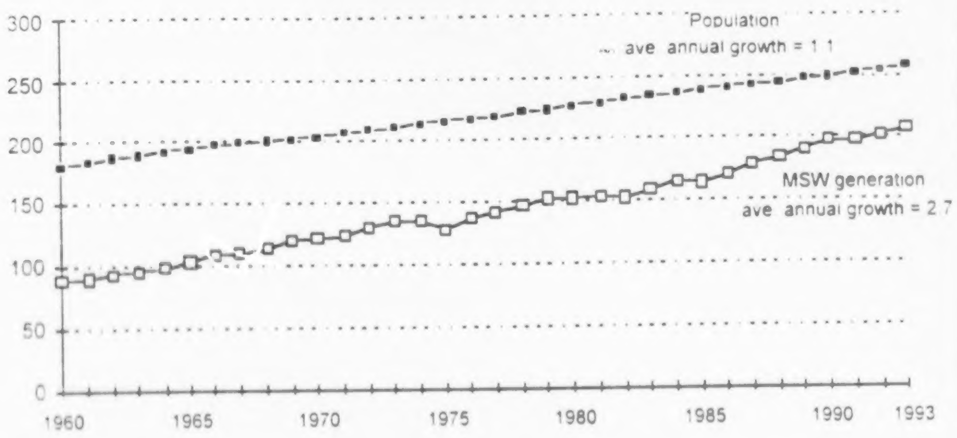
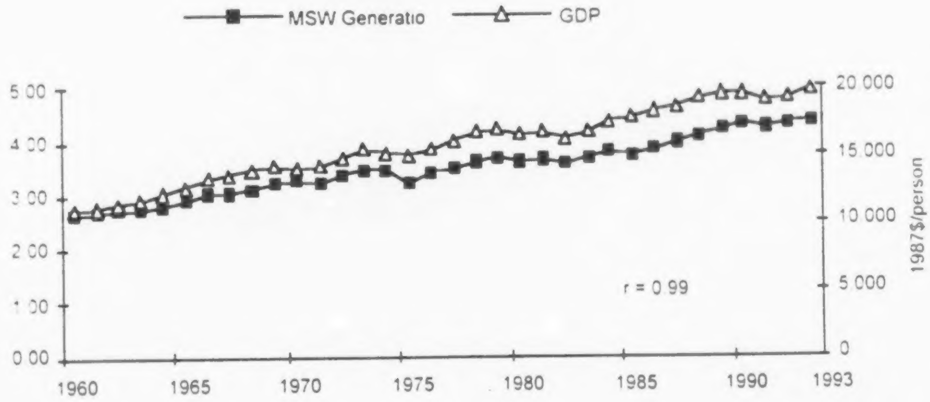


Figure ES-8. MSW generation and Gross Domestic Product, 1960 to 1993



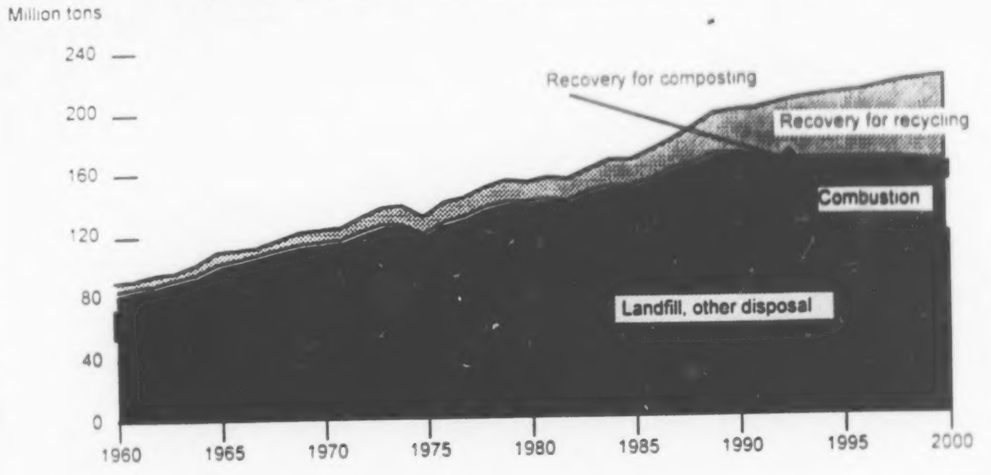


Figure ES-9. Municipal solid waste management, 1960 to 2000

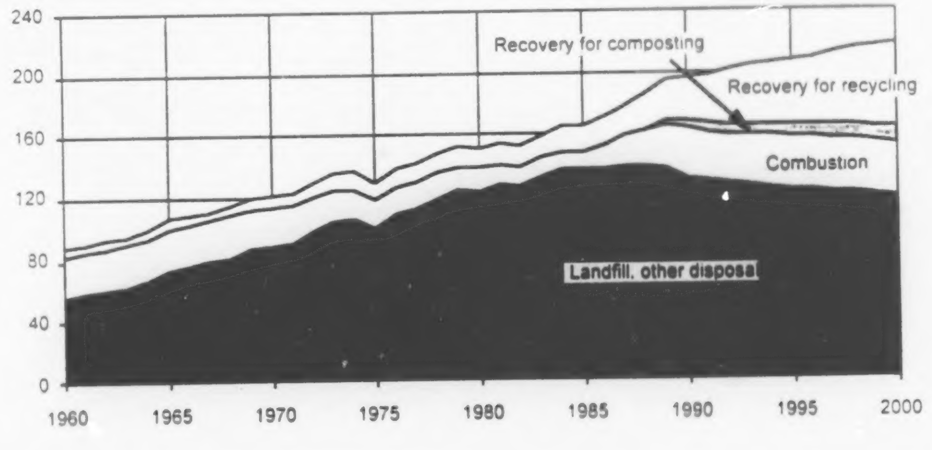
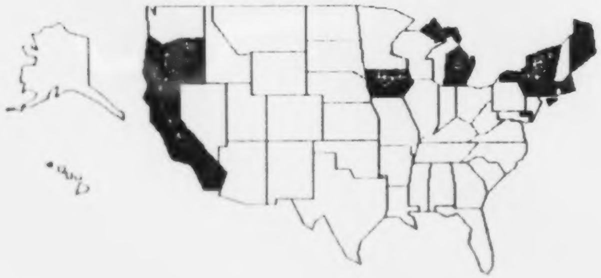


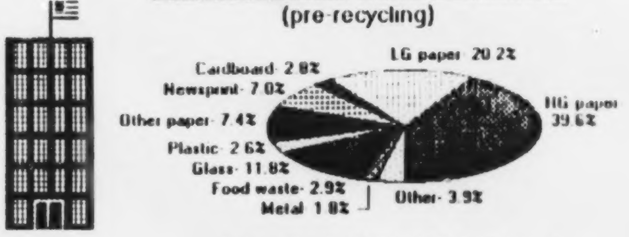
Figure ES-9. Municipal solid waste management, 1960 to 2000

STATE'S WITH BOTTLE DEPOSIT RULES



COMPOSITION OF THE WASTE STREAM AT A LARGE FEDERAL OFFICE BUILDING

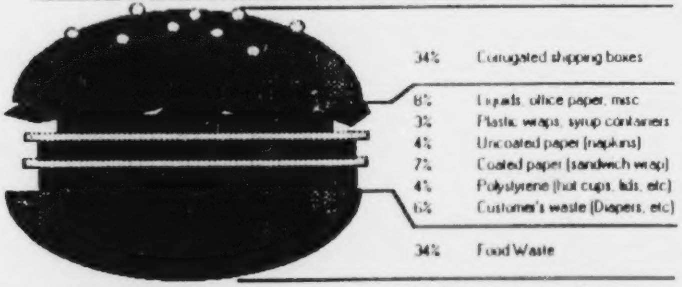
(pre-recycling)



TOTAL GENERATION = 2.9 lbs/employee/day

Source: EPA Waste Composition Study, Sept., 1992

WASTE GENERATION AT A FASTFOOD RESTAURANT

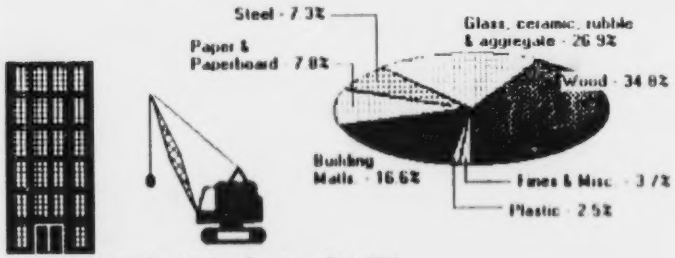


A typical McDonalds serving 2,000 customers generates 238 pounds of waste per day.

Source: Environmental Defense Fund Study, Nov., 1990

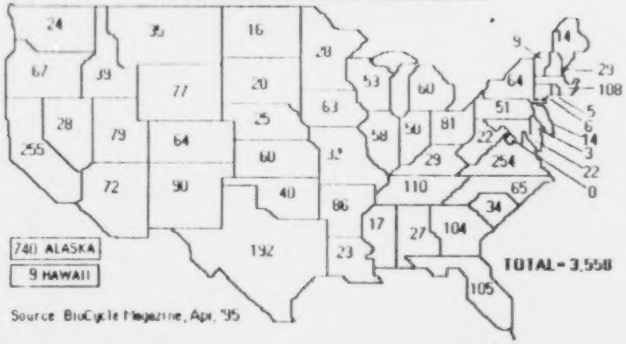
CONSTRUCTION & DEMOLITION WASTE

(average composition, as disposed)



Source: Metropolitan Toronto Waste Composition Study, 1991

NUMBER OF LANDFILLS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35
16
28
67
39
77
20
53
60
9
14
29
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64
25
63
58
50
81
51
5
6
14
3
22
0
28
79
64
60
32
29
22
254
255
72
90
40
86
110
65
34
17
27
104
192
23
105
740 ALASKA
9 HAWAII
TOTAL - 3,558

Source BioCycle Magazine, Apr. '95

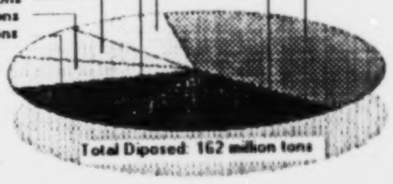
WASTE MANAGEMENT PRACTICES, 1960-2000
(in pounds per person per day)

	1960	1970	1980	1990	1993	2000
Generation	2.66	3.27	3.65	4.35	4.39	4.32
Recovery for recycling/composting	0.18	0.23	0.35	0.72	0.96	1.30
Discards after recovery	2.48	3.04	3.30	3.63	3.44	3.02
Combustion	0.82	0.67	0.33	0.70	0.70	0.67
Discards to landfill	1.67	2.37	2.97	2.93	2.74	2.35
Population (in millions)	180.7	204.0	227.3	249.4	257.9	276.2

Source EPA Waste Characterization Report, Franklin Assoc., 1994

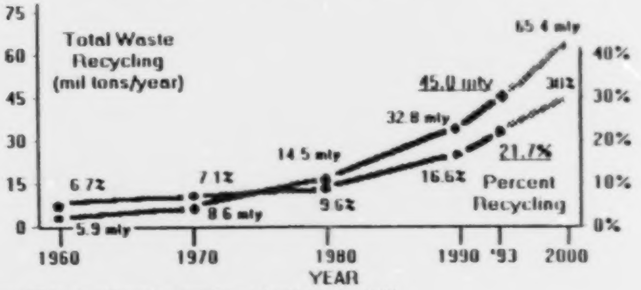
1993 NET WASTE DISPOSAL - 162 MIL. TONS
(after recycling)

Paper & Paperboard	31.7%	51.4 mil tons
Yard Waste	16.2%	26.3 mil tons
Plastics	11.5%	18.6 mil tons
Food Waste	8.5%	13.8 mil tons
Metals	7.4%	11.9 mil tons
Glass	6.6%	10.7 mil tons
Other	18.1%	29.3 mil tons



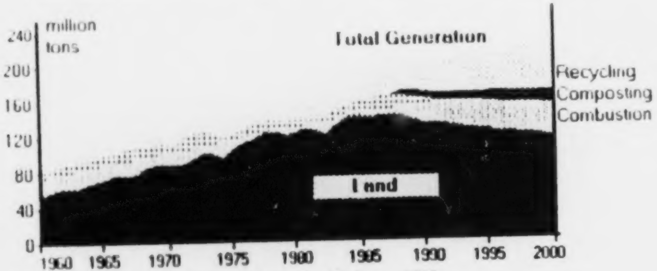
Source EPA Waste Characterization Report, Franklin Assoc., 1994

WASTE RECYCLING RATES - 1960 TO 2000



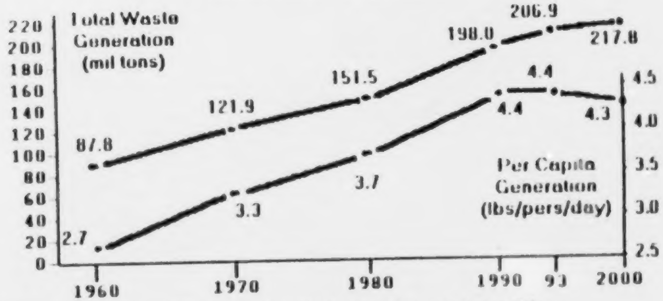
Source EPA Waste Characterization Report, Franklin Assoc., 1994

TRENDS IN WASTE GENERATION, RECOVERY & DISPOSAL



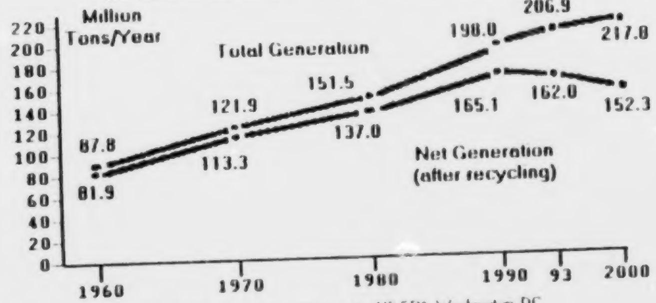
Source EPA Waste Characterization Report, Franklin Assoc , 1994

WASTE GENERATION RATES - 1960 TO 2000



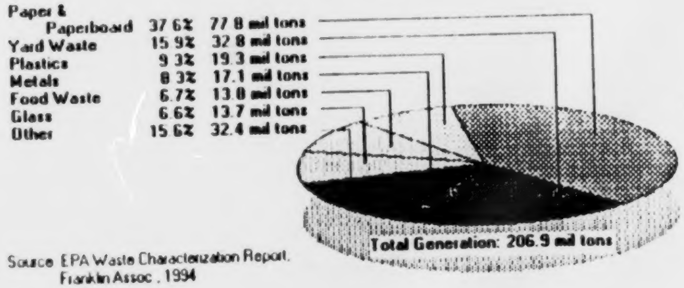
Source Characterization of MSW in the US 1994 Update, US EPA, Washington, DC

TOTAL & NET WASTE GENERATION - 1960 TO 2000



Source Characterization of MSW in the US 1994 Update, US EPA, Washington, DC

1993 TOTAL WASTE GENERATION - 206.9 MIL. TONS
(before recycling)



Source EPA Waste Characterization Report, Franklin Assoc , 1994

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EQUIVALENT FUEL VALUES
(AS RECEIVED BASIS)

Component	Btu/lb
Coal (Anthracite)	13,500
Coal (Bituminus)	14,000
Peat	3,600
#2 Fuel Oil	18,000
#2 Fuel Oil (Btu/gal)	139,000
#2 Fuel Oil (Btu/Bl)	5,285,000
Natural Gas (Btu/CuFt)	1,116
MIXED MSW	4,800
Mixed Paper .	6,800
Newsprint	7,950
Corrugated	7,043
Junk Mail	6,088
Magazines	5,250
Mixed Food Waste	2,370
Wax Milk Cartons	11,325
Polyethylene	18,687
Polystyrene	16,419
Mixed Plastic	14,100
Tires	13,800
Leaves (50% moist.)	3,535
Leaves (10% moist.)	7,984
Grass (65% moist.)	2,690
Green Wood	2,100
Cured Lumber	7,300

printed from The EPA Municipal Solid Waste Factbook Version 2.0, May 24, 1995, Washington, DC

Mail Preference Service
Direct Marketing Association
P.O. Box 9008
Farmingdale, NY 11735-9008

Dear Sir or Madam:

Advertising Mail is filling up home and office waste baskets at an astounding rate. In 1990, third class mail made up more than 2% of the waste thrown away in the U.S. - 3.6 million tons.

I would like to reduce the amount of unwanted advertising mail I recieve by having the following name(s) removed from computerized mailing lists:

Name:

Address:

Signature:

Name:

Address:

Signature:

Name:

Address:

printed from The EPA Municipal Solid Waste Factbook Version 2.0, May 24, 1995, Washington, DC

ULTIMATE ANALYSIS OF MUNICIPAL SOLID WASTE

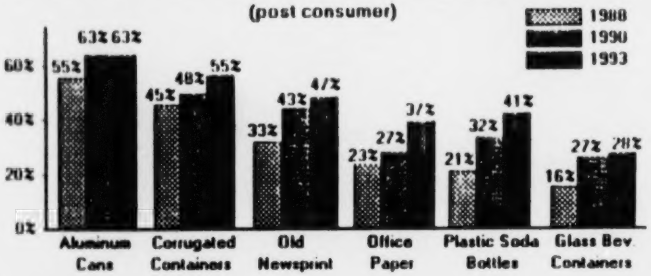
(percent by weight)

MATERIAL	C	H	O	N	Cl	S	Moisture	Ash	HHV (Btu/lb)
Mixed Waste	27.5	3.7	20.6	0.45	0.5	0.83	23.2	23.4	4,810
Corrugated	36.79	5.08	35.41	0.11	0.12	0.23	20	2.26	6,322
Newsprint	36.62	4.66	31.76	0.11	0.11	0.19	25	1.55	6,233
Magazines	32.93	4.64	32.85	0.11	0.13	0.21	16	13.13	5,466
Other Paper	32.41	4.51	29.91	0.31	0.61	0.19	23	9.06	5,481
Plastics	56.43	7.79	8.05	0.85	3.00	0.29	15	8.59	11,586
Rubber/Leather	43.09	5.37	11.57	1.34	4.97	1.17	10	22.49	8,433
Wood	41.20	5.03	34.55	0.24	0.09	0.07	16	2.02	6,933
Textiles	37.23	5.02	27.11	3.11	0.27	0.28	25	1.98	6,595
Yard Waste	23.29	2.93	17.54	0.89	0.13	0.15	45	10.07	4,005
Food Waste	17.93	2.55	12.85	1.13	0.38	0.06	60	5.10	3,265

Source D.A. Tillman, "The Combustion of Solid Fuels & Wastes," Academic Press, San Diego, 1991

RECYCLING RATES OF KEY CONSUMER ITEMS

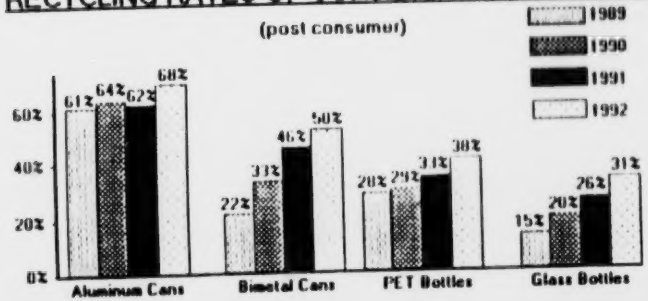
(post consumer)



Source Characterization of MSW Reports, Franklin Assoc, 1990 94

RECYCLING RATES OF SOFT DRINK CONTAINERS

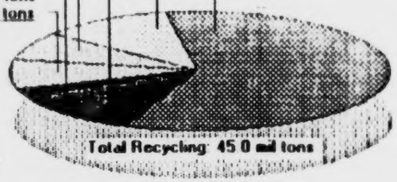
(post consumer)



Source National Soft Drink Assoc, 1993

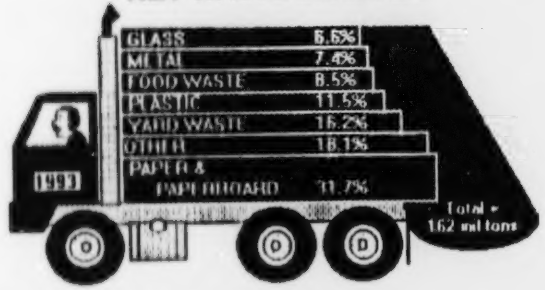
MATERIALS RECYCLING IN 1993

Paper & Paperboard	58.9%	26.5 mil tons
Compost	14.4%	6.5 mil tons
Metals	11.6%	5.2 mil tons
Glass	6.7%	3.0 mil tons
Plastics	1.6%	0.7 mil tons
All other	6.9%	3.1 mil tons
Total	100%	



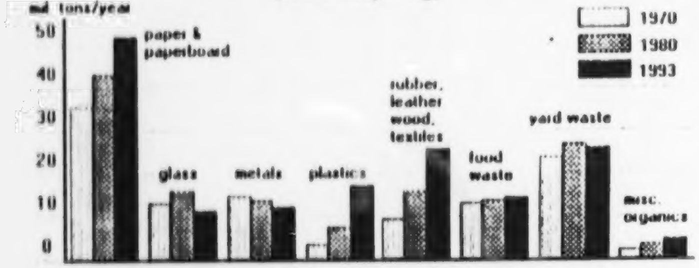
Source Characterization of MSW Report, Franklin Assoc, 1994

NET WASTE DISCARDS



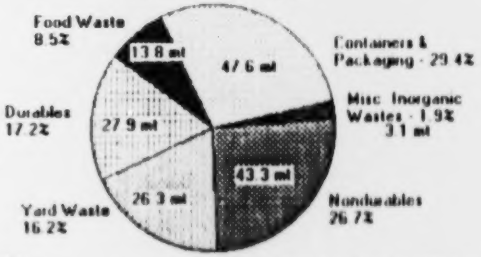
Source EPA Waste Characterization Report. Franklin Assoc., 1994

NET DISCARDS OF MATERIALS IN MSW
(after recycling)



Source EPA Waste Characterization Report. Franklin Assoc., 1994

PRODUCTS DISCARDED IN MSW, 1993
(after recycling)



mt = million tons

Source EPA Waste Characterization Report. Franklin Assoc., 1994

BIBLIOGRAPHY

BIBLIOGRAPHY

AVR Teacher's Resource Guide. Montpelier, VT: Association of Vermont Recyclers, 1989.

Action for a Cleaner Tomorrow: A South Carolina Environmental Curriculum. South Carolina Department of Health and Environmental Control, 1994.

All Trashed Out. Illinois Department of Energy and Natural Resources, 1992.

Appelhoff, Mary. Worms Eat My Garbage. Kalamazoo, MI: Flower Press, 1982.

A-Way With Waste - A Waste Management Curriculum for Schools (2nd Edition). Washington State Department of Ecology.

Baldwin, J. and Stewart Brand, eds. The Essential Whole Earth Catalog. Point Foundation, New York, NY: Doubleday, 1986.

Bern, Robyn. Everyone's Guide to Home Composting. New York, NY: Van Nostrand-Reinhold Co., 1978.

Blackburn, John O. and Margaret Crouch. Energy Dictionary. Arlington, VA: Volunteers in Technical Assistance, 1982.

Bowker, Michael. "Caught in a Plastic Trap," International Wildlife. May-June 1986, vol. 16 no. 3 pp. 22-23.

Bradley, Fay. "Throwaway Three," Lessons From Litter. Atlanta, GA: Atlanta Clean City Commission, 1979.

Branley, Franklyn M. Water for the World. New York, NY: Sterling Publishing Co., Inc., 1981.

Bulette, Sara. "Adventures of Ranger Rick: Used Oil," Ranger Rick May 1984, vol. 18 no. 5.

Carawan, Guy. The Land Knows You're There. (Sound Recording/LP) Flying Fish Records, 1986.

Carpenter, John. Creating the World: Poetry, Art, and Children. Seattle, WA: The University of Washington, 1986.

Characterization of Municipal Solid Waste in the United States: 1960 to 2000: Update 1988. Prarie Village, KS: Franklin Associates Ltd.

Clean S.W.E.E.P., Iowa Department of Education, 1992.

Columbus Clean Community. Biodegradable. Columbus, OH: Columbus Health Department, Office of Litter Control, 1987.

Council for Solid Waste Solutions. "The Urgent Need to Recycle," Time. July 17, 1989, vol. 134 no. 3.

Dyckman, Claire and A. William Way. Clean Water, Streams and Fish: A Holistic View of Watersheds. Everett, WA: The Adopt-A-Stream Foundation, 1978.

Easterbrook, Gregg. "Cleaning Up Our Mess," Newsweek. July 24, 1989, vol. 114 no. 4.

Eckstein, Aleene and Alice R. Shannon. How to Make Treasures From Trash. Greatneck, NY: Hearthside Press, 1972.

Eckstein, Aleene. The Super Scrap-Craft Book. New York, NY: New American Library , 1984.

Ehrlich, Paul. The Machinery of Nature. New York, NY: Simon and Schuster, 1987.

Fibers International. Experimenting: Make Your Own Paper at Home by Recycling.
1533 120th Avenue NE, PO Box 1691, Bellevue, WA: Fibers International, 1985. (206) 455-9811.

Garbology, Recycling In Schools: A Guide to Accompany the Television Program, "Full Circle." The Big Sweep '91, Chapel Hill, NC.

Glenn, Jim and David Riggle. "Where Does the Waste Go?" BioCycle May-June 1989, vol. 2 no. 3, pp. 34-36.

Golden, Augusta. Water: Too Much, Too Little, Too Polluted? New York, NY: Harcourt Brace Jovanovich, 1983.

Hayes, Denis. "Repairs, Reuse, Recycling: First Steps Toward a Sustainable Society." Worldwatch Paper #23 Washington, DC: Worldwatch Institute, Sept. 1978.

Heimler, Charles. Basic for Teachers. Santa Cruz, CA: Mitchell Publications, 1987.

Herbert, Don. Mr. Wizard's Supermarket Science. New York, NY: Random House, 1980.

Here Today, Here Tomorrow: A Curriculum on Recycling, Energy, and Solid Waste (K-12). Conservation and Environmental Studies Center, Inc. New Jersey Dept. of Energy, Office of Recycling, 1982.

Holmes-Shuett, Amy and Greg Shuett. Earth Day 1990. Stanford, CA: Stanford University, 1990.

Worm Sources. Jerry's Worm Ranch, 8608 S. 134th, Seattle, WA 98178. (206) 271-1388.

Johnson, Cecil E. "The Wild World of Compost," National Geographic. Aug. 1980. pp. 273-284.

Klein, Kathy. Let's Put Waste In Its Place. Philadelphia, PA: Philapride, Inc. 1989.

Lauber, Patricia. Earthworms: Underground Farmers. Champaign, IL: Garrad Publishing Co., 1976.

Lauber, Patricia. Too Much Garbage. Chicago, IL: Garrard Publishing Co., 1974.

League of Women Voters of Massachusettes. Beginning at Home: Tackling Household Hazardous Wastes. (video tape, 18 min., color) 8 Winter St., Boston, MA: Massachusettes League of Women Voters.

Little, Dennis L., Robert E. Dills, and John Gray, eds. Renewable Natural Resources: A Management Handbook for the 1980's. Boulder, CO: Westview Press, 1982.

Luther, Sallie. "Milk Carton Mania," Ranger Rick. June 1987, vol. 21 no. 6, pp. 4-10.

Manheim, Bruce S. and Michael J. Bean. The Growing Threat of Plastics Adrift at Sea. New York, NY: Environmental Defense Fund, January 1988.

Matison, Jim. The Only Barter Book You'll Ever Need: How to Swap, Barter, and Trade and Make Your Best Deal. New York, NY: Bantam Books, 1984.

A Users Guide to Yard Debris Compost. Metropolitan Service District (2000 SW 1st Ave., Portland, OR 97201), 1989.

Miles, Betty. Save the Earth: An Ecology Handbook for Kids. New York, NY: Alfred Knopf, 1974.

Municipal Solid Waste Management 1991 Teacher's Guide. Aurora, CO: Aurora Public Schools, 1991.

Municipal Solid Waste Management 1993 Teacher's Guide. Aurora, CO: Aurora Public Schools, 1993.

O'Hara, Kathryn J., Suzanne Iudicello and Rose Bierce, A Citizen's Guide to Plastics in the Ocean: More Than a Litter Problem. Center for Maine Conservation, Inc., 1988.

Pennsylvania Recycling and Waste Reduction Curriculum Activities. Pennyslvania Dept. of Education - Office of Environmental Education and Pennsylvania Dept. of Environmental Resources Bureau of Waste Management.

Rathje, William and Cullen Murphy. Rubbish! The Archeology of Garbage. Harper-Collins Publishing, 1993.

Recycled - Mobius Curriculum: Understanding the Waste Cycle. Browning Ferris Industries, 1992.

Recycling Study Guide. Wisconsin Dept. of Natural Resources, Bureaus of Solid Waste and Information and Education.

Rethinking Recycling - An Oregon Waste Reduction Curriculum. Oregon Dept. of Environmental Quality for Oregon Educators, 1993.

Ripples: A Big Sweep Elementary Activity Guide. Big Sweep, 1990.

Schwartz, Stephen C. "Recycling: the State of the Art," Recycling Today. July 1988, vol. 26 no. 7, pp. 32-34.

Dr. Seuss. The Lorax. New York, NY: Random House, 1971.

Seymour, John and Herbert Girardet. Blueprint for a Green Planet. New York, NY: Prentice Hall, 1987.

Sheehan, Kathryn and Mary Waidner. Earth Child. Council Oak Books, Tulsa, OK.

Sierra Club, School Gardens: Earthcare in the Dooryard Garden. (brochure, 12 pages) 1976. Sierra Club Public Affairs, 730 Polk Street, San Francisco, CA 98109.

Silverstein, Shel. "Hector the Collector," and "Sarah Cynthia Sylvia Stout Would Not Take the Garbage Out," Where the Sidewalk Ends. New York, NY: Harper and Row, 1974.

Stroessner, Wayne. "Small Town Recycling," Resource Recycling. March-April 1988, vol. 7 no. 1. p. 18.

Sullivan, George. How Do They Package It? Philadelphia, PA: Westminster Press, 1976.

Turner, Christopher, "Eco-Labeling in the European Community," Health Harvest. March-April, 1993.

U.S. Environmental Protection Agency. Let's Recycle: Lesson Plans for Grades K-6 and 7-12. Washington, DC: Office of Waste and Waste Mangement, 1980.

Washer, Carolyn and Steve Steiner: Oliver Otter - No Time to Waste: Hickory, NC: Garbage Disposal Service (GDS).

Western Regional Environmental Education Council. "Aquatic Project Wild," Project Wild. Salina Star Route, Boulder, CO 80302. (303) 444-2390.

Western Regional Environmental Education Council. "Which Niche?" Project Wild. Boulder, CO: Western Regional Environmental Education Council, 1987.

White, Peter F. "The Fascinating World of Trash," National Geographic. April 1983, vol. 163 no. 4.

Zaslow, Sandra A., Wilma Hammett and Janice Holm Lloyd. Master Waste Manager - Sorting It All Out Together. Raleigh, NC Cooperative Extension Service.

GLOSSARY

GLOSSARY

acrylics:	materials derived from acrylic acid and commonly used in paints, varnishes, and fabrics.
aerobic:	living only in the presence of oxygen: e.g. aerobic bacteria.
agriculture:	relating to farming; growing food products in a contained environment.
air pollution:	contamination of the air in the environment with gases or particles of matter that can be harmful to living organisms.
alloy:	a substance that is a mixture of two or more metals and other materials.
aluminum:	a hard, light metallic element found in the ore bauxite; aluminum is capable of being shaped or rolled very thin and is non-magnetic.
anaerobic:	living in the absence of free oxygen; e.g. anaerobic bacteria.
appliance(s):	a device or piece of equipment that uses a power source and is designed for a specific use such as a refrigerator, air conditioner, etc.
aquifer:	an underground rock formation that contains significant amounts of groundwater and may supply water to wells and springs.
archaeology:	the study of civilizations through skeletal remains, fossils, and tools.
aseptic packaging:	multi-layer packaging.
auction:	a sale of goods, often used items, sold to the highest bidder.
awareness:	possession of information that can lead to action.
bacteria:	single-celled microorganisms; found in many shapes and forms.
barter:	to trade by exchanging one commodity for another.
bauxite:	the principal ore of aluminum consisting chiefly of aluminum oxide or hydroxide with various impurities.
bimetal:	composed of two different metals that are not fused together into an alloy.
biodegradable:	capable of being broken down (decomposed) into basic elements by biological processes.
bioindicators:	living organisms that show changes in the condition of the environment. Some organisms may be observed for sensitivity to specific conditions.

biomonitors:	living organisms that are observed in order to test the intensity of environmental changes.
Bottle Bill:	a legal mandate requiring a deposit on packaging containers. Most often restricted to beverage containers. Deposit monies often used to support recycling efforts.
by-products:	(see "waste by-product")
CFC's:	chloroflurocarbons. Commonly used in refrigeration and proven to be destructive to the ozone layer.
capacitors:	devices consisting of conducting plates to facilitate electrical storage.
carboneous materials:	materials or substances that contain carbon.
casting(s):	soil-like material formed by materials that have passed through the digestive system of worms.
cellulose:	a complex carbohydrate that is the chief part of plant tissues and fibers. Used in the manufacture of paper and textiles.
ceramics:	objects fashioned from clay and fired at extremely high temperatures in a kiln.
chemical reaction:	a change resulting in new products with a different molecular make-up from the original products.
choice:	the act of choosing; selection.
chrome:	a process on metal in which a solution of dichromate is used to treat the surface.
clay:	soil that is composed of fine particles which make it nonporous and pliable.
collage:	a composition of picture cut-outs pasted to a picture surface.
combustible:	capable of being ignited or burned.
compaction:	compression of materials into a smaller space than they existed originally.
compost:	a mixture of mostly decayed organic matter that is used to restore nutrients and texture to soil.
compostable:	having the ability to be broken down by microorganisms into compost; characteristic of much organic waste and some mineral waste.
composting:	the act of collecting decaying organic matter for use to enrich the soil.
consequences:	the results of an action.

conservation:	protection of a natural resource to prevent it from being destroyed or used unnecessarily.
conserve:	to keep in a safe or sound state.
consignment store:	a store that sells goods for individuals. Owners receive payment only when goods are sold.
consume:	to use up or spend.
consumer:	one who uses; in the environment, those organisms that feed on producers.
consumption:	(see consume)
control sample:	part of an experiment used to check the results of variables that are introduced.
convenience:	agreement, harmony - favorable or advantageous condition.
convert(ing):	to change from one use or purpose to another.
corrugated cardboard:	cardboard that has ridges and furrows giving it a wavy surface.
cost effective:	those processes that allow a profit to be made in the production and packaging of commodities.
cycle:	a recurring sequence of events that occur in such an order that the last event of one series immediately precedes the first event in the next series.
debris:	the remains of objects or materials that have broken down or torn apart.
decompose:	to break down from complex to simple substances through chemical means.
decomposer:	a tiny organism that feeds on organic waste materials, breaking them down into constituent elements or compounds.
decomposition:	(see decompose)
degrade:	to harm something, such as the environment.
demand:	how much something is wanted, especially in regard to purchasing goods or services.
discard:	to throw away or cast off.
dispose:	to discard; to get rid of or throw away.
disposal:	the process of getting rid of waste; can be properly or improperly done, depending upon the consequences for the environment and public health.

dump:	(see open dump)
durables:	consumer goods whose usefulness continues over several years such as automobiles, appliances, etc.
earth quilt:	a piece of art created from solid waste materials and sewn or taped together in a quilt format.
eco-label:	a label that carries a pro-environmental message.
entangled:	twisted together, intertwined, interwoven so as to be difficult to separate.
environment:	the circumstances or conditions that surround living organisms including people; includes everything around us—people, weather, animals, plants, soil, water, buildings.
environmental management:	the overseeing and protection of the environment by government groups, private organizations, and individuals.
environmentalist:	an individual who is familiar with issues relating to the conditions and treatment of the environment.
erosion:	the breaking down or wearing away of the earth's surface by natural processes; weathering.
excessive:	more than the usual, proper, or normal amount.
extraction:	the process of taking a resource from the earth and/or removing or separating (metal) from ore.
ferrous metal:	metal containing iron; is magnetic which facilitates the separation of recyclable materials made from iron.
fertilizer:	substance that adds nutrients to the soil as manure or lime or commercially prepared mixtures of nitrogen, phosphate, and potash.
field notebook:	a record of observations and measurements made by scientists during investigations of the environment.
filter:	a device for separating impurities from a liquid or gas as in the cases of polluted water and smoke in the air.
finite:	having definite limits; coming to an end.
flammable:	capable of being easily ignited and of burning rapidly.

food chain:	organisms in a community that constitute a feeding chain in which food energy is transferred from one organism to another as each consumes a lower member and in turn is eaten by a higher member.
fossil fuels:	a fuel containing solar energy that was absorbed by plants and animals in the geologic past and thus is preserved in organic compounds in their remains. Fossil fuels include petroleum, natural gas, and coal.
garbage truck:	vehicle used to collect and transport solid waste to an area for disposal.
glass:	a hard, brittle substance usually transparent or translucent made from minerals including sand silica (quartz and opal silica) which are fused with soda ash and lime.
groundwater:	the water below the surface of the earth that fills all the spaces between rocks and soil and composing the water table.
habitat:	the place where a plant or animal lives or grows.
harmful:	causing or capable of causing physical or mental damage to living organisms.
hazardous:	(see hazardous waste).
hazardous waste:	waste that provides special problems to living creatures or the environment because it possesses one or more of the following characteristics: poisonous, explosive, capable of dissolving flesh or metal, readily burnable with or without a flame, carries disease, is radio-active.
human-made:	objects or materials created or constructed by a person or persons.
humus:	the organic part of soil, resulting from the partial decay of plant or animal matter.
hypothesis:	a theory or supposition that is tentatively taken to be true; provides a basis for explaining certain facts; is investigated by conducting experiments.
individually wrapped:	a group of items in which each member is covered with a separate wrapper such as gum, candy, etc.
incineration:	burning solid waste to reduce volume or to recover energy to produce hot air or water, steam or electricity.
incinerator:	structure designed to burn solid waste.
industrial:	products and/or materials resulting from an organized industry (especially manufacturing).
inorganic:	composed of matter other than that of plants or animals; most inorganic matter does not contain carbon, does not biodegrade and is derived from mineral sources.

inorganic waste:	waste or excess materials that do not have an organic origin; not derived from plants or animals.
interdependent:	mutually reliant in living and working.
landfill:	(see lined landfill)
latex:	a milky liquid in some trees and plants such as the rubber tree and used in many household products such as paint.
leachate:	a liquid substance, often hazardous to nature, that forms in landfills as the result of rain or other liquid percolating through waste matter; can be a threat to the quality of groundwater used by households if migrates away from site.
lined landfill:	often referred to as "sanitary landfill;" a place where refuse is buried, compacted and covered with soil and that have special construction features such as plastic liners and methane gas monitoring systems. Sanitary landfills are distinguished from dumps (or open dumps).
litter:	human-generated solid waste that is put in the wrong place or allowed to escape from a container.
machines:	apparatuses or devices designed to assist with work.
magnet:	an object having the ability to attract iron and to create a magnetic field surrounding iron objects.
magnetic steel:	steel (commercial iron and carbon alloy) that will attract iron and create a magnetic field.
manage:	to control and direct the handling of solid waste materials to best meet the needs of humans and the environment.
management:	(see manage).
marine debris:	the remains of materials broken down or dumped in a marine environment.
mass:	the amount of matter composing an object.
mass produce:	to make large quantities of a standardized commodity.
metabolize:	to go through the chemical changes in an organism that provide the energy for life processes.
metals:	elements such as iron, gold, aluminum which are obtained from ores in the earth; are malleable, ductile, shiny, and good conductors of heat and electricity; examples of these alloys are brass, bronze, etc.

microbes:	minute organisms too small to see without magnification.
mineral:	an inorganic crystalline element or compound with a specific chemical composition.
molten:	melted by heat.
municipal:	of or relating to the internal affairs of a local government.
natural:	containing no artificial or synthetic materials.
natural materials:	materials that occur in nature; not manufactured or human-made.
natural resource:	(see renewable resource)
nitrogenous materials:	materials or substances that contain nitrogen.
non-biodegradable:	not capable of being broken down by biological processes.
noncombustible:	not capable of being ignited or burned.
non-compostable:	not appropriate for or not capable of producing compost; generally includes items which will not biodegrade and are inert (i.e. glass, stone, etc.).
nonferrous metal:	metal not composed of nor containing iron, such as aluminum, copper and brass.
nonporous:	a substance that will not allow fluids (or air) to pass through.
non-renewable resource:	a natural resource that cannot be renewed or regenerated except over very long periods of time.
nylon:	a synthetic material made from carbohydrate polymers and used to make textiles, plastics, tires, etc.
obsolete:	no longer in use; not current.
ocean:	the large body of saltwater that covers about three-fourths of the earth's surface. This body is geographically divided into five general sections -- Pacific, Atlantic, Indian, Arctic, and Antarctic.
oil:	(see petroleum)
open dump:	an open land site where garbage and trash are deposited; usually unsightly and possibly harmful in nature; often referred to as open dump, distinguished from a landfill.
organic:	derived from living organisms or containing carbon compounds.

organic waste:	waste material that has resulted from living or once living organisms.
ozone:	form of oxygen containing three oxygen atoms (O3).
ozone safe (products):	those products that pose no threat to the layer of ozone in the atmosphere that protects the earth from ultraviolet radiation.
PCB's:	polychlorinated biphenyls used in electrical capacitors, a carcinogen to humans.
packaging:	covering, wrapper or container, often designed to attract purchasers as well as to protect a product from damage or spoilage.
paper:	a thin sheet of material made of cellulose pulp, derived mainly from wood, rags, and certain grasses; used chiefly for writing, printing, drawing, packaging and covering walls.
paper pulp:	a mixture of cellulose materials such as wood, paper and rags ground up and moistened to make paper.
Papyrus:	a kind of writing paper made from the pith of the papyrus plant.
permeability:	the ability to allow something, in particular a liquid, to pass through.
persuade:	to win over by an appeal to reason.
petroleum:	a natural, thick, oily, flammable, dark liquid mixture found beneath the Earth's surface; used to make such products as natural gas, gasoline, lubricating oils, plastics, etc.
photodegradable:	ability to be broken down into simple components through the action of light.
physical property:	trait of a material or substance that when changed does not change its molecular structure, such as changes related to size or state of matter (solid, liquid or gas).
pigment:	fine, powdery, insoluble materials used as coloring agents in paint, cosmetics and ceramics. Also a color-producing substance found in tissues and cells of animals and plants.
plant:	the land, buildings, machinery and fixtures employed to recycle materials for reuse.
plastic:	made from organic compounds such as petroleum that can be molded, cast, drawn, or laminated into objects.
pollution:	the contamination of soil, water, or air by the discharge or improper disposal of harmful or inert substances.
polystyrene:	a rigid polymer used as an insulator and in molded products such as Styrofoam cups, plates, etc.

porous:	full of pores through which fluids (or air or light) may pass.
post-war age:	the time period following a war usually spanning several decades.
precycling:	thinking of the environment before buying or using something, selective purchasing to reduce the amount of solid waste generated for disposal.
processed materials:	raw materials that have been extracted and refined in preparation for use in manufacturing.
processing:	the act of preparing a commodity from raw materials to a usable consumer product.
producer:	an organism that makes its own food through the process of photosynthesis.
property (physical & chemical):	the traits or characteristics of a substance determined by the senses or by the effect of another substance upon it.
public service announcement:	information aired by the media at no charge that is deemed to be of interest to the community or of value to its safety and protection. (PSA)
pulp:	a cellulose material prepared chiefly from wood and used to make paper.
purchasing criteria:	rules or tests by which the buying of products is judged.
purify:	to rid something of impurities, to cleanse; particularly the filtering of water and air.
rayon:	a fiber made from cellulose (wood pulp or cotton) and used in the textile industry.
rain forest:	a tropical woodland that has an annual rainfall of at least 100 inches.
raw materials:	materials suitable for processing and development into finished goods.
recovering:	placing back into a usable form as opposed to disposing.
recyclable:	the ability to be used again to be made into a new or similar product.
recycle/recycling:	to collect and process waste materials for use in manufacturing new products.
red worms:	scientific name *Eisenia foetida*. Used to decompose food waste and produce castings, a dark soil-like material.
reduce:	(see source reduction)
refuse:	anything thrown away or rejected because it is convenient to do so or because it is thought to be useless; garbage and trash.
renewable:	capable of being replenished by a new supply or continual growth and development.

renewable resource:	natural resources which can be renewed or regenerated by natural ecological cycles or sound management practices, e.g. trees and water.
repair:	to restore an object to its original condition by replacing broken or missing parts.
represent:	to act or personate the role of; a dramatic exhibition or stage production.
resin:	a complex, generally hard substance made of carbon, hydrogen, and oxygen, also, a secretion from certain trees and used in turpentine, glue, and varnish - also, any of the chemical compounds known as plastics.
resource:	something that can be used to make something else.
reusable:	objects or materials that can be used again.
reuse:	to use again; to extend life of an item by repairing it or by creating new uses for it.
sanitary landfill:	(see lined landfill).
sanitation:	the practice of keeping the environment clean and organisms healthy by the proper disposal of waste or the purification of water and air.
sculpture:	an image or representation formed with a chisel or other carving tool.
security:	dependability; freedom from danger - safety.
senses:	those organs that allow one to perceive changes in the external environment.
simulation:	an activity designed to duplicate in a simpler way the actual activities and processes of a real life situation.
slurry:	a watery mixture of insoluable matter.
solid waste:	waste generated from households, institutions and commercial establishments.
solid waste management:	planning and using various methods to dispose of solid waste, to reduce the quantity of waste, to reuse, recycle or compost materials and/or to use waste material to produce energy or fuel. Also includes collecting, transporting, and disposing of waste.
sort:	to separate objects from other objects based on special properties such as size, shape, color, etc.
source:	point of origin; the natural resource from which raw materials come or from which they must be extracted and refined; typically includes plants and ores.
source reduction:	to reduce the amount and/or toxicity of a waste material.

Styrofoam:	commerical name for polystyrene (see polystyrene).
substitute:	to take the place of.
sulfer dioxide:	heavy, colorless gas that is very toxic to plants and fairly toxic to humans. It is produced by burning coal, smelting, and other industrial processes.
swap:	(see barter).
synthetic:	produced by human means through chemical synthesis rather than of natural origin.
synthetics:	materials produced artificially through a process using complex substances such as hydrocarbons.
tin:	a naturally occuring metal that has a low melting point and is malleable and ductile.
toxic:	referring to, or caused by a poison; poisonous.
trade(ing):	(see barter).
trash:	broken, discarded or worthless things, rubbish and other forms of refuse which are not food waste.
treasure:	something of great worth or value.
urban:	relating to or taking place in a city.
vermicomposting:	use of worms to decompose organic waste into castings.
volume:	the space occupied by an object and measured by multiplying an object's length, width, and height together.
war shortage:	reduced availability of products and goods due to demand created by military activity during a war.
waste:	anything that is worthless or useless; material which cannot be reused or recycled and hence must be discarded or disposed of.
waste by-product:	material or substance resulting from manufacturing processes which can often be reused or recycled or may have to be disposed of.
waste crisis:	a problem with some part of an integrated solid waste management system.
waste management:	(see solid waste management)
waste paper:	paper that has been discarded.

waste reduction:	the process of reducing the total amount of solid waste produced by society. Methods include reducing, reusing, and recycling.
waste stream:	the continuous flow of solid waste that travels from generators.
wastewater treatment plant:	a facility where liquid wastes are treated and processed so that what remains may be returned to the environment safely.
water pollution:	the contamination of rivers, lakes, oceans, and groundwater.
wildlife:	living things that are neither human nor domesticated.
wood pulp:	(see pulp).